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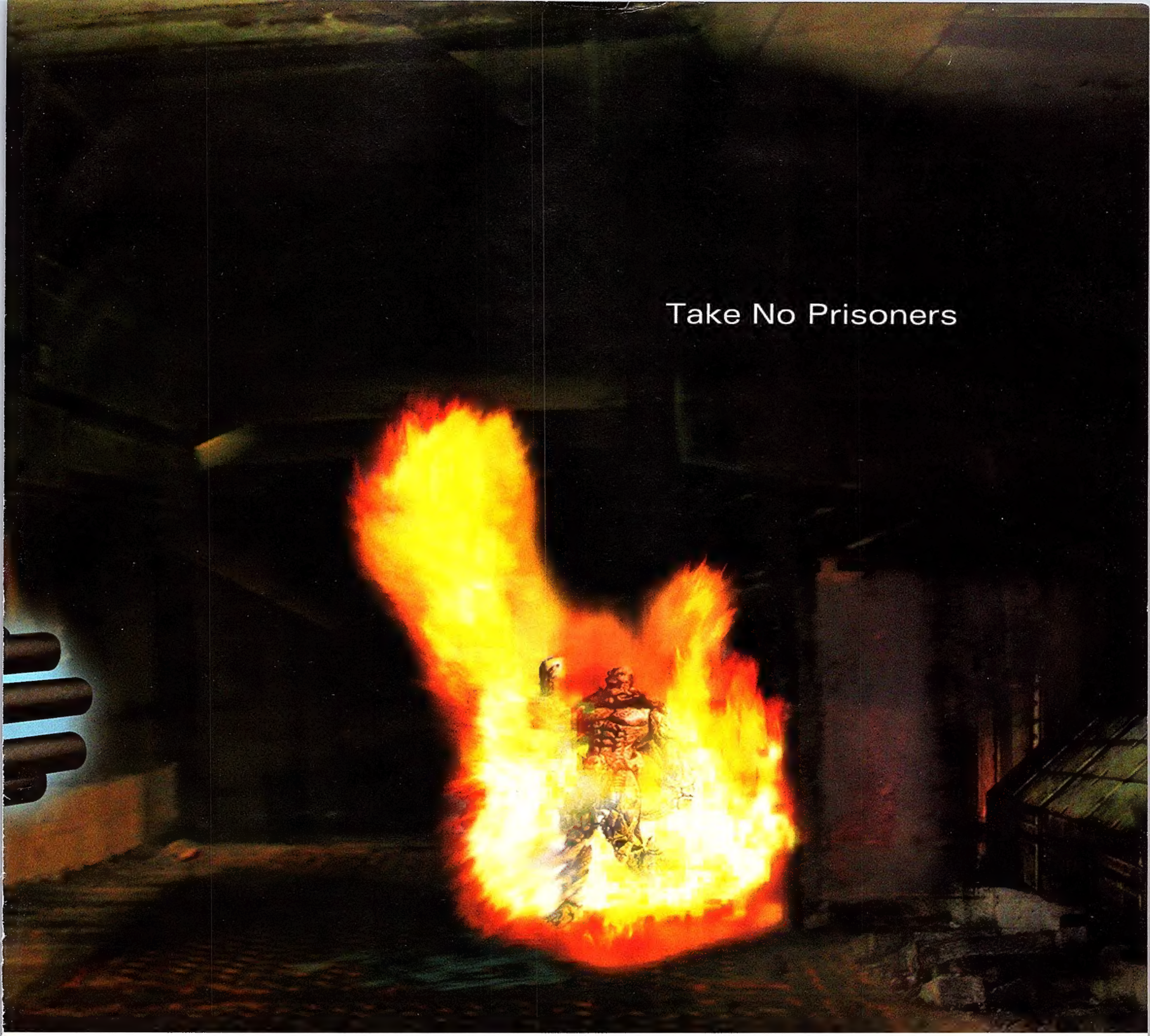

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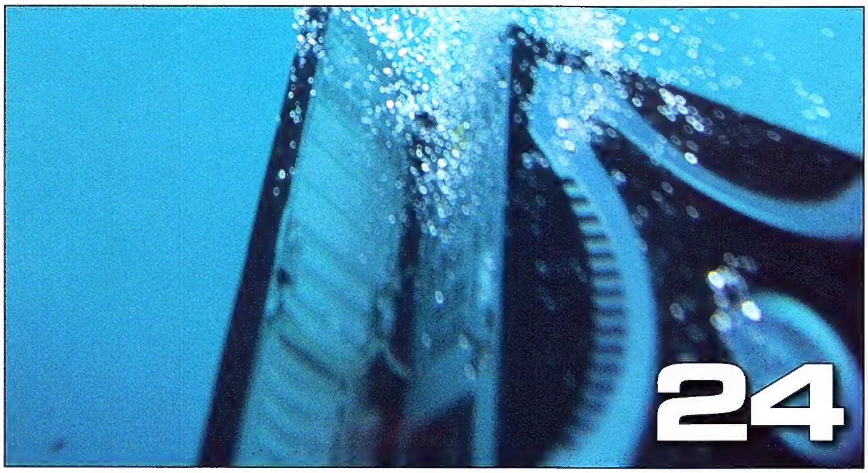
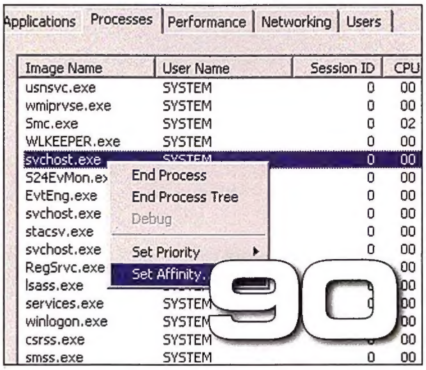
CONTENTS





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lsass.exe                                        00
services.exe      SYSTEM                         00
winlogon.exe      SYSTEM                         00
csrss.exe         SYSTEM                         00
smss.exe          SYSTEM                    0    00
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FEATURES

Wet and wired 24

Water-cooling is imposing, yes, and *Atomic* wanted to take the scariness out of it. If you're looking to overclock to the max or simply run a silent PC, then this is the guide for you.

Fallout 3 30

Bethesda, the developer of Oblivion, flew us to its nice home in Washington DC. While there we asked the hard questions and got the good answers on Fallout 3. Read our exclusive coverage, right now.

Computex 2007 8

Craig Simms, a man with more than just a love of tech, went to the world's most delightful PC hardware expo and got the gossip on the latest bits coming out of Taiwan. His words are on these pages.

Head to head: Budget PC cases 44

Josh Collins went to town on a bunch of cheap PC cases. Well, they're cheap in price, but not quality, and the greatest of them can be found here.

Engine Room: BioShock 66

The FPS to end all first person shooters? Maybe. We asked Jon Chey at Irrational that exact question, with minor changes, and you can read his response in our preview this month.

Music in Linux, part 2 86

Leigh Dyer hasn't stopped working on his open source music machine, and neither should you. Keep on going with the second part of his comprehensive tutorial.

Optimise Windows for dual-core 90

Don't let your Core 2 or Athlon X2 waste its potential! Jake Carroll shows you how to maximise their performance in Windows XP and Vista.

REGULARS

LOGIN

Update 8
Computex 2007; Why you don't need DirectX 10; SimCity gets civil.

Chat 16
John Romero comes out of hiding to talk with Alexander Gambotto-Burke.

X-Ray 19
Ashton Mills throws a few batteries in a fire.

Technica Obscura 22
Ashton Mills dreams of originality, and there are no games in them.

HARDCORE

How we test 42
Benchmarks with extra benchmarks.

Gearbox 50
It's the little things that count.

Kitlog 58
In the market for a new machine? Build your perfect beast here.

Ground Zero 60
Dan Rutter needed something to do while his saved game loaded.

Hardcore Reviews

Gigabyte GA-P35T-DQ6 52
Kingston HyperX PC3-11000 53
Thermaltake Toughpower 1200w 53
MSI P6N Diamond 54
Hitachi Deskstar 7K1000 55
Pioneer DVR-212 55
AOC 210V 56
Cooler Master Real Power M1000 56

GAMEPLAY

Geekette 82
Kate Inabinet is too good for her own, er, good.

Game reviews

Transformers: The Game 74
The Darkness 76
Overlord 78

Culture Shock reviews

Black Sheep 80
Rant 81
Deadwood: Season 3 81
Jin-Roh: The Wolf Brigade 81

TECHNIQUE

Input Output 94
Dan Rutter doesn't use tools to repair things, he just thinks them fixed.

Hotbox 96
Scrumptious modding goodness for your eyes. If eyes could indeed taste.

Fallout 98
Logan Booker will make you laugh so hard, your ears will drop off.

EDHEAD

New & old

Hardcore is the theme this month, as it is to a degree every month. But we've outdone ourselves massively for *Issue 79* by including two chunky features on what are institutions in their respective worlds.

Owning a custom-made, water-cooling rig is a badge of honour that should be worn with pride. To go to the effort of cutting tubes, tightening valves and risking hundreds, if not thousands, of dollars worth of equipment to the liquid-holding properties of plastic, metal and your own elite abilities is an accomplishment. We understand that not everyone has a firm grasp of the concepts involved, and so *Atomic* has come to the rescue. Starting from page 24, you'll learn the essentials of water-cooling your PC and perhaps, take your first steps towards pure awesomeness.

The second institution is Fallout, a role-playing game so fondly remembered, there are gamers who pray for nuclear war just so they can live the life of the Vault Dweller. A little while ago, Bethesda, the same company that brought us Oblivion, picked up the rights to the decade-old franchise with plans to bring us a third instalment. Bethesda was nice enough to fly us over to the States to check out its progress on the title, and I have to say, there's a lot to report. Some parts impressive, others disappointing, Fallout 3 will be a mixed bag of tricks when it hits in spring of next year. While all the details are carefully planned out starting from page 30, don't expect to see isometric, turn-based combat, and for that matter, Fallout as we know it.

At this point I'd usually talk about what the rest of the magazine has in store for you, but instead I would like to welcome Josh Collins to the *Atomic* writing team. Josh has a great head on his shoulders, one finely-tuned to the frequencies of hardware and tweaking, and will show his finesse in the issues to come.

Sadly, though, while we greet Josh, we also have to wave goodbye to Craig Simms. Craig joined *Atomic* a few years back with more than a few barrels of knowledge and passion strapped to his back. Having fully unloaded them into the pages of this fine magazine, he's off to try his hand at other things. Of course, we wish him the best of luck with all that he does.

Without any further bantering, I wish you oodles of joy on your journey through this month's issue. Read, and be well.

Logan Booker
lbooker@atomicmpc.com.au

Issue 77 winners: 5x copies of Hellsing Ultimate DVD. V. Ledden, Narabgba QLD; S. Noske, Ferntree Gully VIC; H. Ngo, Waterloo NSW; A. Sanderson, Bathurst NSW; C. Rumble, Elanora QLD.

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S.T.A.L.K.E.R: Shadows of Chernobyl from THQ

Gamers can sate their gaming appetite with this highly-acclaimed survival horror First-Person Shooter (FPS) game from THQ. With atmospheric and immersive gameplay, this game utilises the powerful performance of the ASUS EAH2900XT to serve up a unique gaming experience like no other.

> **"This cutting-edge graphics card utilises the latest generation AMD GPU"**

"The Black Box" from Valve

Valve's latest offerings into the gaming arena are included in their "The Black Box" bundle suite. Users will be able to use a voucher coupon to acquire free copies of 3 upcoming titles: Half Life 2: Episode Two, Team Fortress 2 and Portal from downloads through Steam – Valve's online platform for PC games when they become available later in 2007. To while away the waiting time, users will be able to enjoy a free copy of Valve's exciting Day of Defeat.

DirectX 10 and Windows Vista Ready

For those gamers who are running Windows Vista, the ASUS EAH2900XT comes equipped with full support for Windows Vista™ and DirectX® 10. The latest ATI Catalyst™ software is designed for quick setup and automatically configures the best system settings for lifelike gaming and visually stunning Windows Aero™ user interfaces.

Exclusive ASUS Features

The ASUS EAH2900XT also provides users with the exclusive ASUS Gamer OSD. This useful feature is able to deliver real - time overclocking and chat options during gameplay – allowing gamers to experience real - time performance upgrades when they need it.

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FREE Bus to MRT
City Bus 937 to MRT
FREE Shuttle Bus to Taoyuan Airpo

COMPUTEX 07

We sent Craig Simms to Taipei to get hot and sweaty with the latest in tech. He came back soaked in the future.

The land of heat, humidity and heat. Taipei is ground zero for Computex, Asia Pacific's biggest trade show, and convergence point for geeks the world around. There are all sorts here, spread out over four huge event halls and a few levels of a hotel over a period of five days – from the multinational mega-players like Intel and NVIDIA, all the way down to the little guys in Hall 3 who are incredibly original, rebranding the same external hard drive cases as their own.

After CeBit in Hannover, Computex is usually the next big event and a launching pad for several company's new and exciting products. However this year things were comparatively underplayed – most likely due to the effects of the AMD/ATI merger that are still being felt. NVIDIA was perfectly comfortable where it was, and so its product range remained untouched. Intel 'officially' launched the P35 and X38 motherboards that we've known about for months, and had a few eight-core 45nm machines on display. AMD partners had plenty of 2400 and 2600 boards on show, but there was no big hullabaloo being made, short of a few dancing girls.

The rest of Computex exploded as it usually does – huge booths, colours, lights, girls, tech, shrill screeching over loudspeakers and more bodies than if someone yelled out 'Stacks on!' with Eddie McGuire in the room.

If there were any trends we picked up, it was all in the memory market. While flash keeps going from strength to strength, the leading memory member would have to be solid-state hard drives. A number of vendors had them in 32 and 64GB variants, with one even hitting 128GB – they're confident that these should very much be in the mainstream and affordable by the beginning of 2009.

DDR3 was another hot one, with Team RAM in particular showing off a 2GHz, CAS 8 pair of sticks. Obscenely expensive and highly impossible to get, but an indication of where we're heading.

COMPUTEX 07

Finally, Robson was out in force, with the much wankier name of 'Turbo memory' – in the form of a PCIe x1 card of flash memory. Robson essentially acts as another level of cache for the hard drive, speeding up delays incurred by the mechanical operation of the hard drive. At this stage we'll see it bundled OEM with whitebox machines, then eventually with motherboards – and hopefully down the track, if the licensing permits, variants from other brands.

This theme carried into memory coolers built into motherboards, and even *memory itself* built into the motherboard.

Check out all the pretty pictures over the next few pages, and make sure to head to **www.atomicmpc.com.au/computex.asp** for the full run down of the show.

---

01 ASUS's EEE notebooks are entry level notebooks that actually look sexy. They use low capacity solid-state hard drives.

02 ABIT's upcoming X38 board. X38s were out in force all over Computex, it's definitely going to be big in the future.

03 The view of one of the halls – Hall 2 was where the big boys came out to play, huge stands and logos dominating the skyline.

04 Gigabyte is branching out yet again, this time into power supplies. There are also sexy new cases and GPS devices, although it's unlikely Australia will see the latter just yet.

05 ASUS had a motherboard with built-in DDR3 RAM. This does mean you can't upgrade your RAM though. There was also a mobo with built-in RAM coolers.

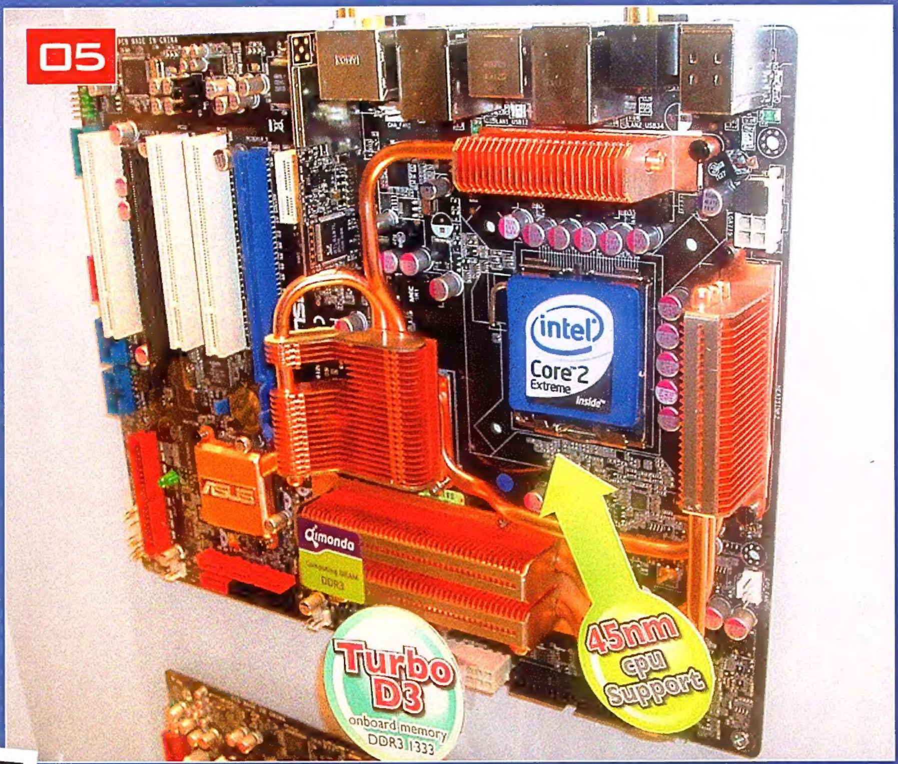
06 Radeon 2400s were everywhere, in both GDDR3 form (*as pictured*) and GDDR4.

07 Intel built this entire skyscraper out of its own chipsets, complete with a little component musical band at the bottom.

08 Retro audio is back! A slick amplifier anyone would love to have on their desk.

09 The blow-up Supreme Commander bot appears to relieve itself on someone's head.

01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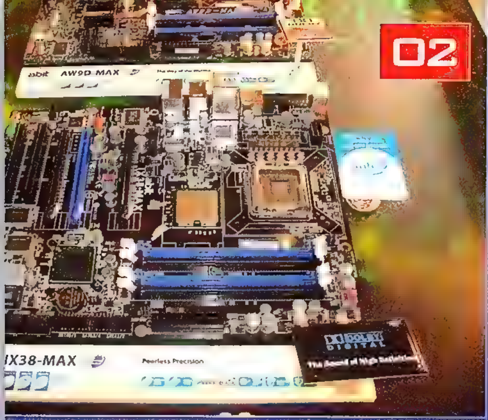
Fatal1ty holds his calling card. Craig holds his. A match made in... er... Taipei.

07

08

02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NVIDIA SLI Certified Power Supply

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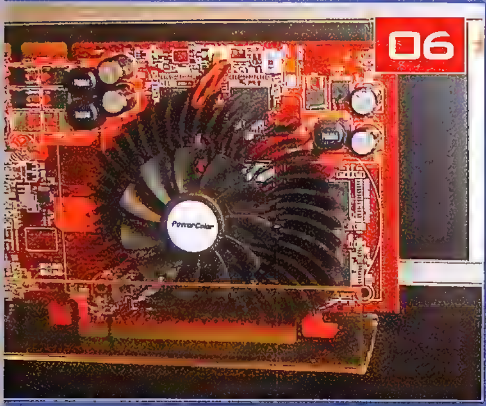
PowerColor

VOLUME

09

GIGABYTE
SUPREME

10

11

14

12

15

13

ONE OF THE FINEST TRADITIONS OF COMPUTEX, THE BOOTH BABE WAS STILL VERY MUCH IN EFFECT.

10 The Gigabyte girls drawing a prize. It's not uncommon for vendors to throw out prizes simply for screaming their name back at them.

11 The Intel crowd with their mechs. The mech+babe combination was prolific.

12 The Intel girls once again proving that PVC is alive and well. A whole truck of the stuff was clearly supplied to the show.

13 The single tallest Taiwanese girl there, at around 6"1'. She helped our memory with Kingston.

14 A-Data went classy. RAM was never so attractive.

15 This Intel dance crew was only Intel's temporarily. They were dancing for almost everyone over the course of the show.

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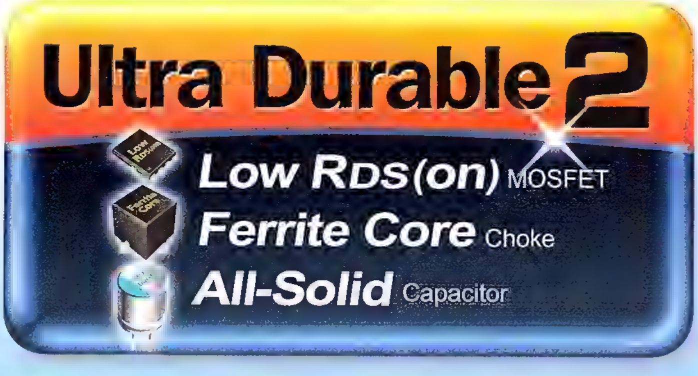

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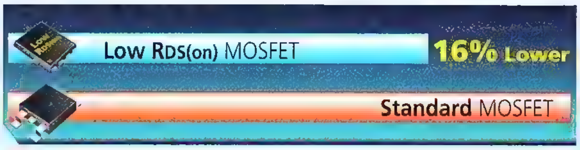

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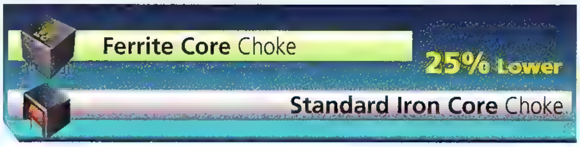
Core Energy Loss



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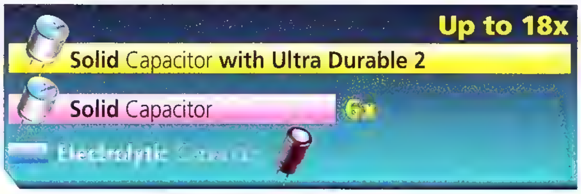

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In the words of Edwin Starr: DX 10, what is it good for?

Why DirectX 10?

Do you need Vista for DirectX 10? David Kidd investigates.

Microsoft's DirectX 10 promises a raft of new graphics features for game developers, but the revolution comes at a price: It's Vista-only. Vista hasn't been particularly friendly to gamers on a number of levels – like dodgy hardware drivers and delayed patches from game publishers – but the seemingly arbitrary restriction of DirectX 10 requiring Vista means you'll have little choice but to ditch XP if you want to run the latest games.

The independent Alky Project from Falling Leaf Systems, however, is aiming to remove the need for Vista by allowing DirectX 10 games to run on XP.

'We are focused exclusively on implementing a set of compatibility libraries which will allow Windows XP users to run any DirectX 10 title they choose,' says Brian Thomason, CEO of Falling Leaf Systems. 'We feel that when our product is released, that game developers will finally have a solution for Windows, Mac and Linux, allowing them the opportunity to provide their games to users of all platforms.'

Microsoft claims that one of the reasons why DirectX 10, or specifically Direct3D 10, requires Vista is because it relies on the new Windows Display Driver Model (WDDM). XP uses a basic 2D driver model that switches over to the GPU for 3D applications, where WDDM, on the other hand, allows multiple applications to make full use of the GPU, a feature required by Direct3D 10.

Thomason, however, says the Alky Project uses a compatibility layer that allows Direct3D 10 functions to be handled by OpenGL instead. Apart from some of Direct3D's newer functions, Thomason says it's not as much as you'd think.

'Geometry shaders are the big beast that needs to be supported in [Direct3D 10]. Pretty much everything else is built on top of the shader/effect subsystem, so it requires very little work on our part.'

In this way, the Alky Project is similar to Wine or Transgaming's Cedega projects, which provide a similar compatibility layer for DirectX 9 and other Windows apps. But Thomason believes the Alky Project fills a gap that these applications aren't touching.

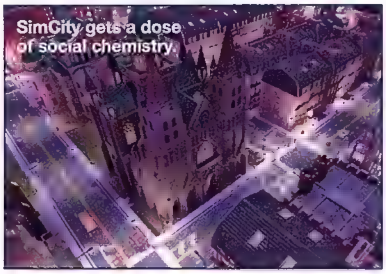
'Wine aims to implement the entire Win32 API; Cedega is focused on DirectX 9 titles at the moment. Alky's sole focus is on implementing a compatibility layer for DirectX 10-based games. Also, Wine and Cedega – and Crossover for that matter – only aim to support Linux and Mac OS X whereas our initial focus is on Windows XP,' says Thomason.

The brains behind the technology is Cody Brocious, co-author of the PyMusique application that strips DRM from iTunes tracks. Falling Leaf Systems also recently merged with a similar XP compatibility application dubbed Project VAIO.

Falling Leaf Systems is making a business model out of the technology by selling DirectX 10 games via an online store, which also grants users a free download of the Alky compatibility libraries.

You can also download a preview of the alpha technology from **www.fallingleafsystems.com**.

SHORT CIRCUITS



SimCity gets a dose of social chemistry.

SimCity is back, but not as you remember it. SimCity Societies is more about societies than cities, replacing sewage pipes and freeway exit ramps with concepts like cultural creativity, obedience, and other 'social energies'. It's not an unexpected change when you consider that the new developers, Tilted Mill, pioneered this kind of abstract city building in games like Children of the Nile and Caesar IV. Due out November 2007.

The Church of England has threatened Sony with legal action for using a realistic representation of the interior of Manchester Cathedral in Resistance: Fall of Man. Sony subsequently apologised for any offence and invited representatives to meet and discuss the Church's demands, which include withdrawing the game from shelves.

Half-Life 2: Episode Two will be released on 9 October, over a year after Episode One. We can't be too annoyed at Valve, considering Episode Two will also include multi-core support, that crazy Portal game and the absurdly long-awaited Team Fortress 2.

Carmack's secret project

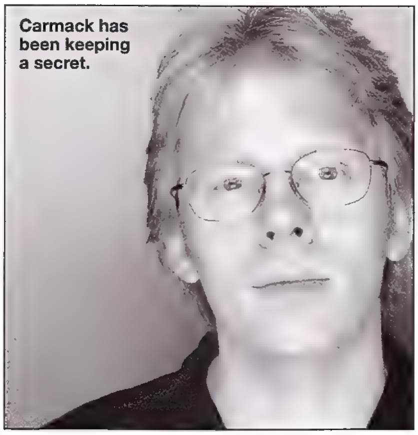
id's new graphics engine sees the light.

Just when you thought John Carmack had settled on making Doom RPGs for mobile phones, he whips out a tech demo that touts expansive outdoor spaces, seamless transitions to indoor areas, and a set of friendly dev tools for content creation. You know, just like the Unreal Engine.

Carmack jumped on stage at Apple's Worldwide Developers Conference in June and talked through a rolling demo of the new engine, rendered in realtime on a Mac.

'So the last couple of years at id we've been working in secrecy on next-gen tech and a game for it. This is the first time we're showing anything we've done on it publicly,' said Carmack.

Apart from introducing another palette of brown, the demo showed off the engine's capability to render wide outdoor areas, before zooming in to an interior environment. The new engine, codenamed id Tech 5, will target PC, Mac, Xbox 360 and PS3. A brand new, unannounced game by id will be the first to use the technology.



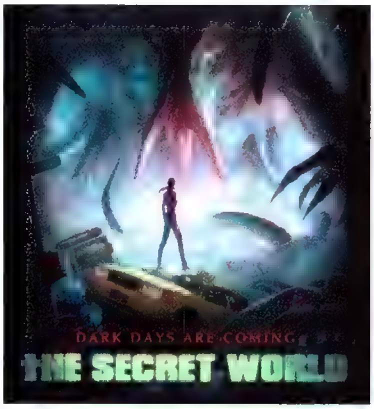
Carmack has been keeping a secret.

Dark days are coming

Funcom announces massively secret online role-playing game.

Age of Conan has barely hit beta, but Funcom isn't standing still. The MMO and adventure game publisher, also responsible for Anarchy Online and Dreamfall, has announced another online RPG called The Secret World, which will apparently offer something different to traditional MMOs.

What's most interesting about the game is Funcom's marketing strategy. Keen fans are already discussing it heavily online and solving various puzzles, with each solution providing some concept art or divulging new information. Sites like **crygaia.com** and **darkdaysarecoming.com** are housing the growing community and collating all known information.



Sifting through the various bits of trivia, TSW appears to be set against a backdrop of conspiracy theories and classic, Lovecraft-inspired mythology. Little is known about the gameplay itself, but given the mysterious marketing campaign, it likely features elements of ARGs (alternate reality games), combined with the puzzle-solving and story-based adventure of Funcom's The Longest Journey series.

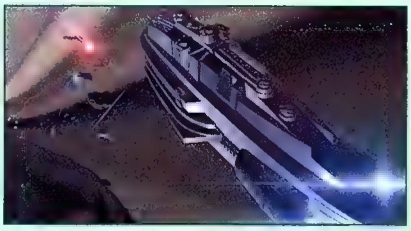
The game is being developed in-house by Funcom, and will use the Age of Conan engine. No release date has been made available as of yet.

A big STALKER patch is on the way from GSC. It will introduce a new freeplay game mode, which ditches the plot missions, letting you just run quests for the AI and increase your ranking against other stalkers. Even more exciting is the upcoming single-player SDK, which will likely bring a torrent of mods.

A new LEGO MMO is on the way from NetDevil, the team behind Auto Assault. Building and construction will likely be at the core of LEGO Universe, but it will also feature other standard MMO concepts like character advancement and social interaction. It's due out in 2008.

The world's most unlikely game heroes.

PIPELINE Hot games to watch out for



Infinity: The Quest for Earth

Release date TBC

For years, EVE Online has mocked the fantasy MMO industry, which fights over the scraps that World of Warcraft tosses its way. But EVE is about to get some competition.

Infinity: The Quest for Earth, like EVE, plays out in a big, singular persistent universe, with factions, alliances and diplomacy. Both focus on multiple playing styles, like combat and trade, and, of course, feature the single worst job in gaming history: Asteroid mining.

Infinity promises an absolutely gargantuan, procedurally-generated universe filled with billions of solar systems, with accurately scaled planets and moons. The combat is real-time, and there are no classes or skills to grind away at. It's either madness or genius.

Platform PC
Developer Flavien Brebion
Publisher TBC
Web www.fl-tw.com

Civilization IV: Beyond the Sword

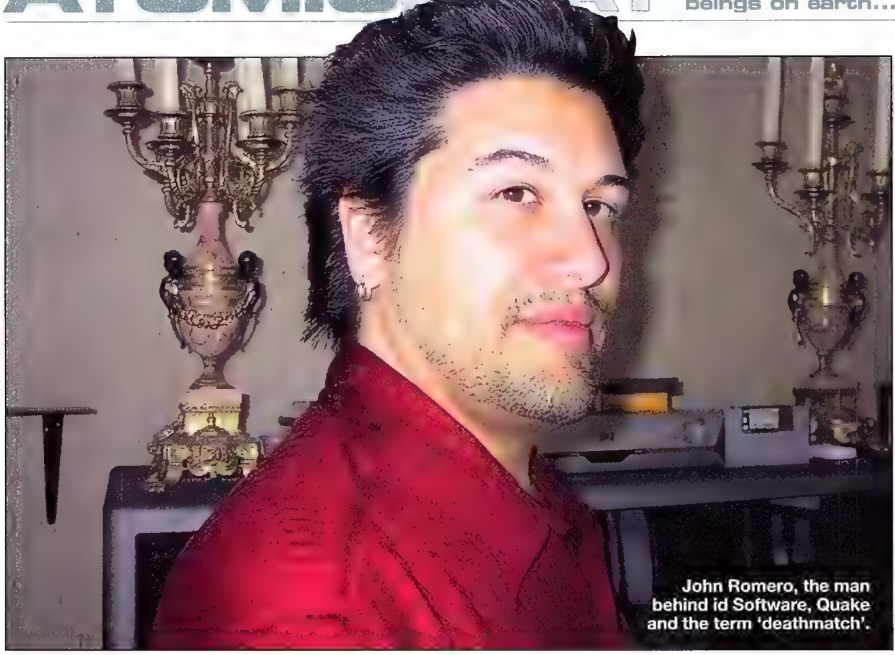
Release date July 2007

Civilization expansions typically involve a few new civs, gameplay tweaks, and some wonders and technologies. Of course, we're talking about one of the greatest games in history here...

But with Beyond the Sword, Firaxis is widening the net. Beyond the new civs and technologies, BtS will focus on new late-game mechanics and a raft of interesting scenarios. One scenario is set on a space map, with planets, galaxies and a range of space ships. Other additions include corporations, which let you exploit resources even more in the later eras, and espionage will play a greater role.

The proposed list of features and tweaks is so long it barely resembles the core game.

Platform PC
Developer Firaxis
Publisher 2K Games
Web www.2kgames.com/civ4/



John Romero, the man behind id Software, Quake and the term 'deathmatch'.

John Romero

Alexander Gambotto-Burke talks to one of today's most infamous game designers on his new massively-multiplayer online game and his involvement with the Cyberathlete Professional League.

atomic Firstly, why do an MMO? It's certainly a very competitive field.

John Romero Well, it's the latest and greatest paradigm of development in gaming. It's the most complex form to develop; it takes a pretty large team and, you know, basically, a lot of work. And they really take advantage of what you can do on the Internet in terms of social networking. It's like you can take any genre that's out there, and when you wrap an MMO around it, you're basically taking that genre, and making it social. And that's how I look at the opportunities to make an MMO – I wouldn't say that games like Dungeons & Dragons Online or Guild Wars are succeeding in that definition, because of all the instancing. I really don't think that an MMO should be like that.

atomic You think it should be about large amounts of players coming together rather than just small groups?

John Romero Exactly, yeah.

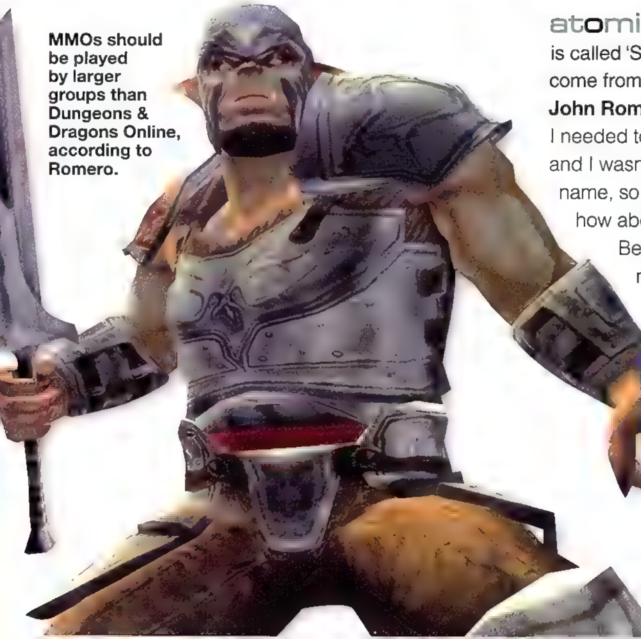
atomic You've said your new company is called 'Slipgate Ironworks'. Where did that come from?

John Romero Just popped into my head. I needed to start doing contracts with recruiters, and I wasn't going to use our real company name, so we needed a DVA. So I said, 'Hey, how about, I don't know, Slipgate Ironworks?' Because we're going to get rid of that name, anyway. We're going to have the true name of the company in about half a year. We'll get rid of both of the names we have right now, and just have one.

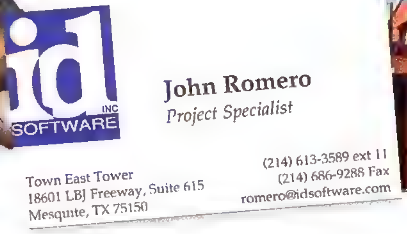
> When money is pouring in constantly, your focus can be 100 percent on quality, not the date.

atomic You said MMOs require large teams – after what happened at Ion Storm, are you wary about having a team that's too large?

John Romero No, because I've learned a lot about it since then. I now know to make sure you have producers that have managed large teams, and make sure you have people on staff who've done it before – as many of those as possible. At Ion Storm, there were a lot of people who'd never done a game before, and there was bad team structure. It really went nuts. Just the amount of people who hadn't done any games – who had never made a game. That was almost the whole company, except for Tom, myself, and a couple of other people. And we're light years away from that now. This is a very different company. This team is great; very professional, the corporate culture is perfect, everyone gets along, and so far, we've done really well. We've hit two huge



MMOs should be played by larger groups than Dungeons & Dragons Online, according to Romero.



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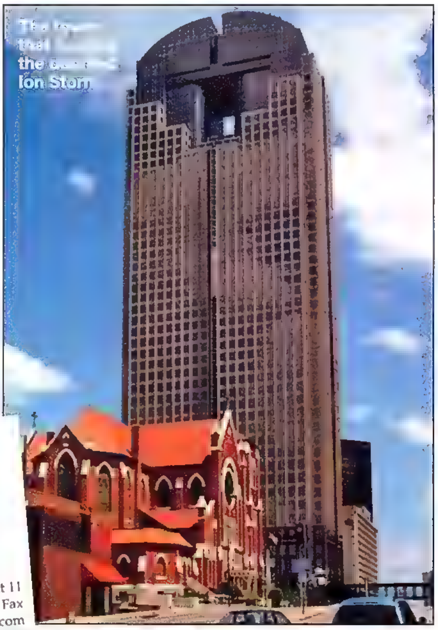

The [illegible] that the [illegible] Ion Storm

Quake 4: But it all started with John Romero's 1996 FPS.

milestones without any crunch time. That's because we have some awesome producers working here.

atomic You've had a complete press blackout on the project. What was the advantage of doing that?
John Romero The main reason we're doing it is that we're basically creating a new category, and we don't want our plans to get out – if everyone's talking about it, that lessens the value of the company if we decide to IPO, for example.

atomic Has the lack of coverage made development more carefree?
John Romero No, it's actually a little tough. It's tough on hiring. It has nothing to do with development, but it's harder to hire, because we had to come up with, basically, a good interview process that didn't give away what our secret software was. Up until we actually make an offer to the candidate, they don't know what they're getting into other than it's a PC MMORPG. And if we like the person, and we get to the point where we do want to make them an offer to join, and they accept the offer, then we can tell them what we're doing. So it really weans out the amount of people that might actually know something, and not be here.

atomic Now, you're also chairman of the Cyberathlete Professional League (CPL) in your spare time.
John Romero Yeah.

atomic You recently announced on the CPL's behalf that a new multiplayer shooter, Severity, was being developed and tailored specifically to the CPL's needs. Why will it suit the league so well?
John Romero Well, it's totally, 100 percent based on competition, versus what other games do, which is try to make the game for an audience that's going to buy the game, and then maybe add some slight stuff into it for competition. But, really, the developer doesn't have a good reason for putting that stuff in, and it chews up resources and time, and publishers don't want to be putting in money for the developers to put this stuff in. After all, they're not going to get anything from it. Usually, competition doesn't see much support other than a few free mods out there, so this is the first game that's being made purely for competition.

atomic What would be the difference between the competition mode you would find in, say, Quake 3, and what's going on with Severity?
John Romero OK, well, probably a simple comparison would be the difference between out-of-the-box Quake 3 and Rocket Arena 3. You know, that was a pretty extensive mod, and that still doesn't incorporate a lot of the stuff Severity has. But I'm not going to be revealing what's going in there because the design isn't finalised, but there's going to be a lot of really great competition-only stuff – the state of the art in cameras, playback, and lots of cool things.

atomic So Severity is going to become the CPL's flagship game at tournaments?
John Romero That's the plan, yeah.

atomic Finally, back to the MMO briefly: Are you following id Software's famous 'When it's done' philosophy with development?
John Romero Right now, yeah, but we'll be announcing later this year when we're going to be done.

atomic How accurate was that statement when you working at id? Didn't you have any internal release dates?
John Romero At id? Oh, no, it was totally 'When it's done'. The thing is, there's a kind of development environment at id that you don't have at other companies. With publisher money, you have to have deadlines, because money runs out. But at a company like id, Epic or even Valve, where you're independent, and you're having money pouring in constantly, your focus can be 100 percent on quality, and not on the release dates. In fact, the release date is the quality, rather than when the money runs out. That's why it was always 'When it's done'. Quake, for example, was meant to come out in Christmas '95, but it didn't, because it wasn't done.

From left to right: John Romero, Steve Wozniak and Tom Hall.

Yes, it's 'that' Daikatana ad.

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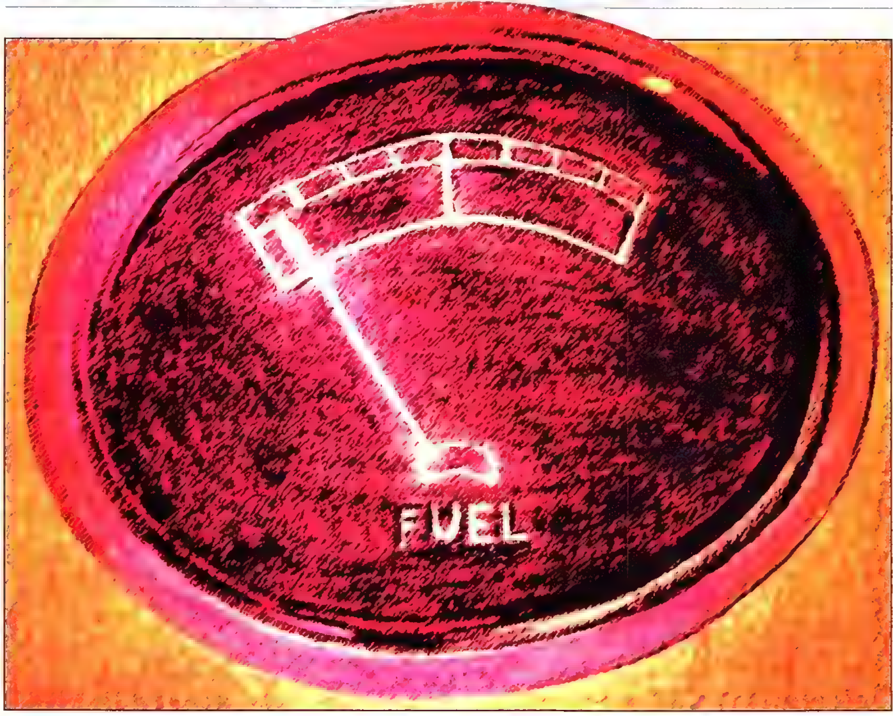


Fuel cells

Heralded as the saviour to our global warming woes, just how do fuel cells work and do they measure up? **Ashton Mills** explores.

Fuel cells boast a wide range of implementations, but the most popular example you've probably heard of is the hydrogen/oxygen variety.

The reason you have heard so much about hydrogen/oxygen fuel cells is because they are in many ways the Holy Grail of energy production – hydrogen is the most abundant element in the universe, which obviously means that we have a plentiful supply, and the by-product of hydrogen/oxygen fuel cell reactants is water, which is about as clean as you can get.

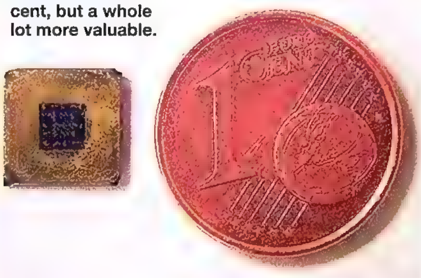
Named after the Hindi word for magic, Jadoo is big in fuel cell development.

Origin of the fuel cell

In recent issues we've covered many cutting-edge technologies that have their roots in the past, and fuel cells are no different. The first fuel cell was built by William Grove in 1843 – though he called it the *gas voltaic battery* – and while there was steady development over the next 100 years, they gained mainstream acceptance when NASA picked up the technology for its space program in the 1960s. Fuel cells are still used today for spacecraft where they produce both electricity and drinking water from the onboard supplies of hydrogen and oxygen.

How they work

Fuel cells are an *electrochemical energy conversion* system that have a structure not too dissimilar to a normal battery – there's an anode and a cathode as well as a fuel, oxidant, and an electrolyte. The key difference between a fuel cell and a battery is that a fuel cell consumes its reactants, and they need to be replaced. However assuming a continuous flow, and combined with the fact that fuel cells have no moving parts, they have the potential to produce continuous energy almost indefinitely.

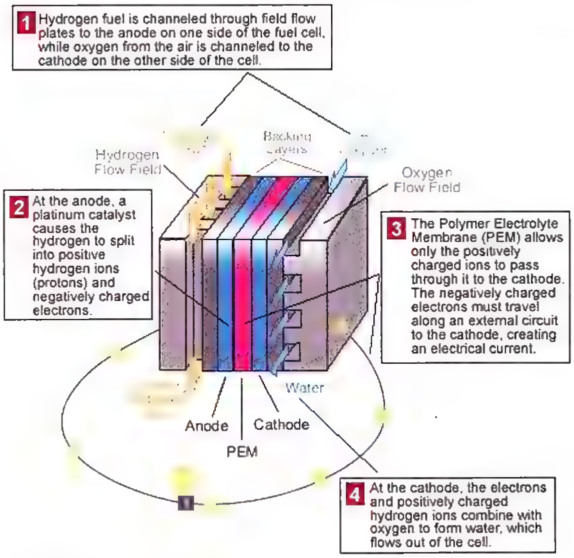


Smaller than a Euro cent, but a whole lot more valuable.

Fuels can be hydrogen, methanol, diesel, and even zinc. Oxidants are usually oxygen, chlorine, or chlorine dioxide. The hydrogen/oxygen reaction is outlined in the diagram below.

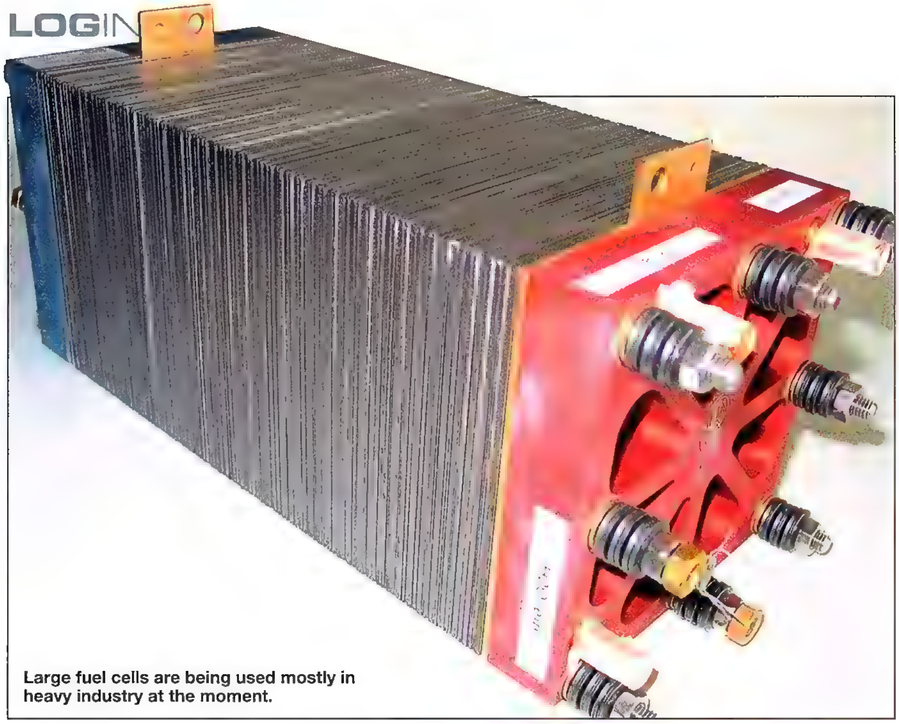
This type of cell is typically called a PEMFC, or *proton exchange membrane fuel cell*, the most popular type of fuel cell in use. Hydrogen is fed into the cell where it reacts with the anode – a metal coated with a platinum catalyst – that causes the hydrogen to split into positively charged hydrogen ions and negatively-charged electrons. The polymer electrolyte membrane (PEM) allows the positively-charged ions to pass through it to the cathode side, where they combine with electrons from an external circuit and oxygen being fed into the cell along the cathode catalyst to produce water and heat. The negatively-charged electrons from the hydrogen reaction can't pass through the PEM and are forced around the membrane to an external circuit – an electrical current.

Individually the cell doesn't pump out a huge amount of current, so the cells are stacked and linked in series or parallel to form *fuel cell stacks*. Depending on the design, a PEMFC can produce between 100W and 500kW.



1 Hydrogen fuel is channeled through field flow plates to the anode on one side of the fuel cell, while oxygen from the air is channeled to the cathode on the other side of the cell.
Backing Layers
Hydrogen Flow Field
Oxygen Flow Field
2 At the anode, a platinum catalyst causes the hydrogen to split into positive hydrogen ions (protons) and negatively charged electrons.
3 The Polymer Electrolyte Membrane (PEM) allows only the positively charged ions to pass through it to the cathode. The negatively charged electrons must travel along an external circuit to the cathode, creating an electrical current.
Water
Anode
Cathode
PEM
4 At the cathode, the electrons and positively charged hydrogen ions combine with oxygen to form water, which flows out of the cell.

Hydrogen/oxygen fuel cell. Source: Wikipedia.


Large fuel cells are being used mostly in heavy industry at the moment.

We'll start to see micro fuel cells in just about everything.

It all sounds too good to be true, and so it's not surprising there are some caveats.

Firstly, fuel cells have an optimum operating temperature range, where efficiency or even damage can occur outside of these ranges. For example, PEMFC fuel cells operate between 70°C to 120°C.

Additionally, the electrolyte membrane needs to be kept moist with a flow of water that allows re-hydration of the membrane at the same rate that evaporation is occurring due to the heat by-product of the process. This is particularly important with the PEMFC design. Too little or too much and the reaction can break down as the membrane fails. For this reason temperature also needs to be managed within the cells.

Then there's always the issue of durability. If a cell is to be cycled frequently – as it might in a car – it needs to handle operating outside its ideal temperate range with minimal or no deterioration, otherwise it might have a very short life expectancy.

And of course, there's the cost, also currently the single biggest hurdle in fuel cell development. Ideally, fuel cells would find their way into everything from your car to your laptop, and indeed there are already prototype fuel cell hybrid cars available, but the technology is cost-prohibitive. In PEMFCs for example, the metal plates used as electrodes and for the fuel and oxidant to flow through; the precious metal catalysts; and the proton exchange membranes are expensive to produce.

There are also some smaller concerns – for example, while hydrogen is the most abundant element in the universe, it's not necessarily readily available on Earth. It can be produced by separating it from hydrogen-bearing compounds, like water, but this takes energy and this cost must be factored into the overall efficiency of the cell. On that note storage and safety are also issues that are still being worked on – you wouldn't your hydrogen laptop, or worse still your hydrogen vehicle, to explode in the event of fuel cell failure.

> “While hydrogen is the most abundant element in the universe, it's not necessarily readily available on Earth.”

Then, of course, there's one final but rather important issue – an infrastructure to produce and supply hydrogen for PEMFCs. It's chicken and egg here – people won't buy fuel cell cars if they can't refuel them of course, and no company will sell hydrogen fuel if no-one is buying fuel cell cars.

Fuel cells today

Large fuel cells have seen some use mostly in industry, especially with power plants, as well some institutions like hospitals, usually as a backup or supplemental power source.

CHP (combined heat and power) fuel cells, usually powered by natural gas, have been produced targeting the home market where, although the efficiency is low, the excess heat produced is used to heat the home and generate hot water. Any power generated and not used by the home can be put back into the grid and sold back to the power company.

Then of course there are hybrid cars, for which quite a few prototypes have been developed by companies like Honda, Ford, General Motors, Toyota and Mercedes. Naturally other forms of transport are viable opportunities too, everything from planes to scooters, though we haven't seen these yet.

And, ultimately, there's technology – mobile phones, PDAs, cameras and laptops can all be powered by micro fuel cells. There are already a number of prototype products available, such as Samsung and Casio's laptop fuel cells and Docomo's mobile phone fuel cell jack in Japan – which actually splits hydrogen out of water as well! Fuel cells can be extremely small – small enough in fact to fit on a silicon die.

Again, it all comes down to cost, efficiency, infrastructure and demand. In a world looking to lessen its dependency on crude oil, investment in alternative energy sources like fuel cells is a given, and considering fuel cells are generally very green pollution-wise and can – depending on the cell – be powered by cheap sources of fuel, it's just a matter of time before they'll be in everything we use.

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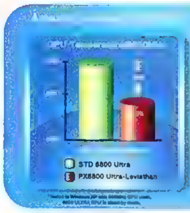

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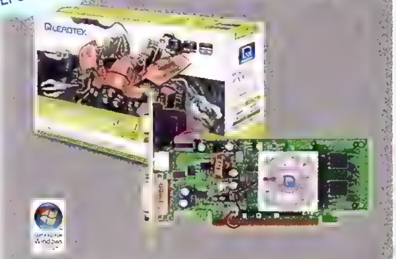

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Crysis: Sex on a bounding pogo stick or just a nostalgic romp onboard an old aircraft carrier?

Old is new again and again

With the gaming industry copying Hollywood classics, has innovation disappeared?

Much like movies, the game industry seems to be ever-focusing on reinventing the past and leaving innovation and creativity in the dust. How many Quakes do we have now? Command & Conquers? Half-Life clones?

Now, even, Speedball 2 is making a comeback – but not as Speedball 3 funnily enough, which it technically is, but as… Speedball 2. Because it's not actually the game that matters, it's the brand, the franchise, the recognisable 'classic' repurposed for the present.

Let's get one thing straight from the start – I'm not against reinventing classics and refreshing them with the latest technology, but it reeks of Hollywood's obsession with remaking – often incredibly poorly – classic movies because that's just a boatload safer than coming up with something new and original.

On the one hand, it *is* great that we'll see a Fallout 3 – I unashamedly admit I'd sell family members for this game – and the System Shock 2 successor BioShock, but if all game publishers ever do is remake old classics then we won't ever be creating the very same classics that are now being used as fodder for the present. They all came from somewhere, they were all untried once.

> “Spore will sell hotter than tickets to a jelly wrestling match between Lindsay Lohan and Scarlett Johansson.”

There was no Half-Life before Half-Life, no System Shock before System Shock, and there was no Dune 2 before Dune 2. There was a time when worlds were created anew, and gamers could immerse themselves in the passion and creativity of developers freed of meeting sales figures. Many games publishers have taken on the Hollywood mentality – buying licences to previously popular games, rather than actually making the Next Big Thing. Because the former is a known quantity, the latter is not.

What's next, an 'all-new' space invaders?

Thankfully not all publishers have cut off their nuts. EA, of all companies, is leading the way with Spore. Regardless of what you think of the previews – though 'awesome' does come to mind – it's a completely new take, a new genre even, and it's for this reason it's one of the most hotly anticipated titles. Perhaps even more than Crysis – because it's *new*.

Without a doubt, Crysis is sex on a bounding pogo stick of joy, but it's still just an FPS. It's still just another nail in a genre done to death, and while I have no doubt it will be fun, I'm all for seeing the odd new take on gaming every now and then, like Spore. It will, purely because it *is* new, sell hotter than tickets to a jelly wrestling match between Lindsay Lohan and Scarlett Johansson.

The bigger the publisher, the more is invested in the titles, the greater the pressure to return a large profit, and the higher the chance of going with a 'sure thing' of an established brand rather than investing in an untried new game.

On the one hand you can't blame them for simply running a business and wanting the biggest possible return. On the other hand it means we see the same old tripe recycled again and again and rarely encounter something genuinely new, that could become the next classic if given a chance.

I wonder if a game like Speedball, or Fallout, or System Shock, or even the grand-daddy of RTS, Dune 2, would even be given a second look by publishers in today's market. After-all, why take a risk?

The answer, of course, is that all of these classics were untried once, and look where we are today. So here's to Spore, to innovation, to creativity, and not to the next Zerg rush.

We now know Ashton loves a bit of deja vu – so send him two emails.

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WET 'N' W

Throwing water into your system is never smart, but people do it all the time to keep their PCs nice and chilly. If you've been wondering about the best way to get started on your own water-cooled computer, Les Maylor of www.radiical.com.au is here to show you how.

Water-cooled PCs are becoming more mainstream as hotter CPUs and graphics cards are introduced. The motivation to water-cool a PC can be sparked by a variety of things including the need to have a quiet computer, to protect system data or to make overclocking and gameplay stable. Whatever your particular reason may be, you've come to the right place if you've been looking for a starter's guide to the mystic art of cooling hardware with fluid.

What is water-cooling?

Simply put, water-cooling is the process of pumping coolant, usually water containing a corrosion inhibitor, through a heat exchanger (water block) attached to the CPU of a computer motherboard. The coolant then passes through a radiator and is cooled by one or more fans. Complex systems can include water-cooled graphics cards and northbridge but a basic system cools only the CPU.

Bits and pieces

To water-cool your CPU you will need to collect the following components:

- Water pump
- CPU water block and fitting kit
- Radiator and mounting kit
- Tubing
- Tubing clamps
- Fan or fans
- Coolant
- Thermal interface material (TIM)

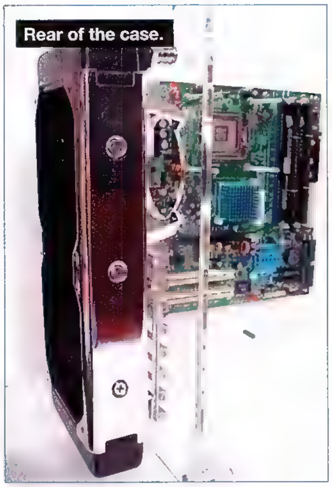
These parts are often purchased separately as parts and assembled into a cooling system, or as a ready-made kit. There are plenty of cheap ready-made kits available on the market, which are a bundle of components. Although these can be useful as entry-level kits it is important to remember that you get what you pay for – cheaper kits usually have cheaper components and some kits will give you results barely better than air-cooling. Cheaper kits can also be based on very narrow ID tubing, which does not allow for any future upgrades. If you do purchase a kit, make sure you buy from a manufacturer that gives good after-sale service. The advantage of buying a better quality kit and/or separate components is that you are able to upgrade and extend your system as required in the future. Good quality components also save money in the long run as they can be re-used on your next system.

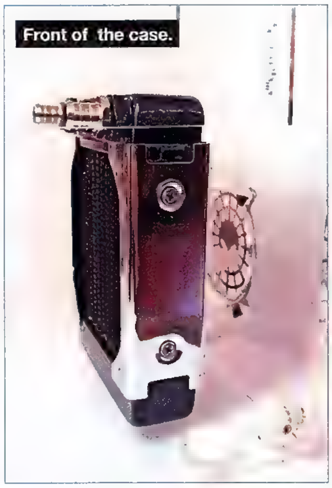
It's important to plan the placement of the parts used in a water-cooled system and see how they fit in the computer case before installation. First, let's take a look at where to place the radiator.

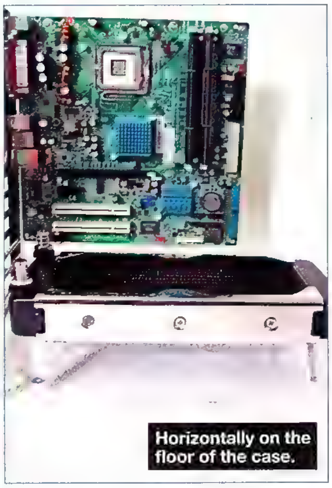
Radiators

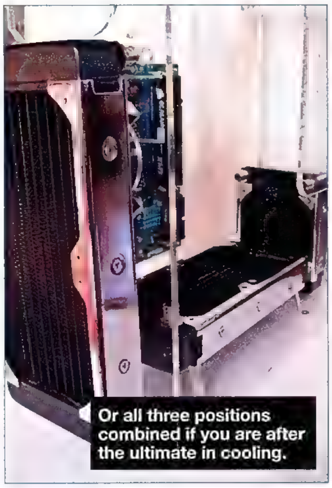
The first issue with fitting water-cooling into a computer case is the radiator placement. The decision where to fit the radiator will be determined by the computer case being used and possible size restrictions. There are few limitations to where the radiator can be placed although using the top of the case has become less popular. Placing the radiator externally has the advantage of maximising airflow and improving access for cleaning accumulated dust. Some manufacturers provide a fitting template for radiator placement. Printing this on overhead projector film gives you a 'see-through' template to help decide placement. Mounting kits such as stand-offs and 'bugs legs' are available to help placement of the radiator and improve airflow. To demonstrate the various radiator placement options, a pre-loved acrylic case has been used in the pictures ahead to give a see-through view of placement options.

IRED


Rear of the case.


Front of the case.


Horizontally on the floor of the case.


Or all three positions combined if you are after the ultimate in cooling.

HANDY HINT:

If you use a 240V pump, just plug the pump and PC into the same power block so that everything turns on and off together. No need for a costly pump relay and less chance of relay failure.

Popular pumps used in water-cooing systems are the 12-volt Laing D5 and the Laing DDC2 18W powered from the computer PSU. The ease of using a 12-volt PSU powered pump is the reason these pumps have gained popularity. AC 240-volt pumps such as the Eheim 1048 and 1250 models are also used, however they are bulkier pumps. A word of warning: None of these pumps will tolerate being run without coolant in them.

Tubing

There is a number of high-quality tubing types available ranging from the expensive laboratory grade Tygon to the more common PVC-based products. In general, the 'best' options are Tygon, Clearflex or MasterKleer. Usually the higher-priced tubing has better flexibility and copes with tight radius bends more than the cheaper thin-walled tubing. Popular tubing sizes are 7/16"ID and ½"ID (internal dimension).

Fans

A common question posed in water-cooling forums is whether to have the fans pull air or push air through the radiator. Very simply whichever way works best for your case configuration and parts placement is the best way. It should be made clear, however, that with radiators, which use densely-packed fins, the consensus of opinion favours pulling air through the radiator rather than trying to blow air through it.

Fan speed will determine the overall efficiency of the system. Faster fans means more airflow, more airflow means better heat removal. Generally fans with an upper value of 70cfm are sufficient for all-year round demands. Varying the voltage during the cooler months of the year can reduce the sound volume of the fans to practically inaudible levels.

Coolant

The most common coolant used in water-cooling systems is either distilled or demineralised water with a 10 percent solution of corrosion inhibitor. The corrosion inhibitor that we use and recommend is Tectaloy concentrate. There are other corrosion inhibitors on the market, for example Nulon. When choosing a corrosion inhibitor, read the types of metal protected by the product and ensure that copper, brass, and if necessary aluminium parts, are protected.

One final note on coolant is that corrosion inhibitor offers some algaecidal action. It is however limited.

For full protection, a small amount of algaecide may be necessary especially in areas where consistently high ambient air temperatures are common. Don't cut corners and use tap water as it can contain contaminants and/or pathogens which may decide to setup a colony and breed in your water-cooling loop. Investing in demineralised or distilled water is a must. It is also important not to exceed a 10 percent solution of corrosion inhibitor in the water.

HANDY HINT:

The importance of the TIM joint should not be underestimated. The success or failure of the system's performance hinges on the quality of the water block mounting and the contact provided at the interface (TIM joint) between water block and CPU.

Corrosion and tarnishing

Copper or brass surfaces will tarnish due to handling and exposure to air. The oxidation or tarnish should not affect the performance of your water block. You can use a proprietary brass cleaner like Brasso to remove the tarnish. For the best results, no polish should be used on the water block base plate before use. If necessary, buff the water block base with a soft, clean cloth.

Thermal interface material (TIM)

Thermal interface material must be applied to the CPU core as part of installation. It is strongly recommended that the TIM that is applied is a high-quality product to ensure maximum performance and minimum errors. High quality brands include, but are not limited to, Arctic Silver 5 and Arctic Ceramique. Check with the TIM supplier for details on the correct application method to be used with your particular CPU. Arctic Silver has set up a webpage to service your particular CPU, be it Intel or AMD. You can find the latest instructions here: **www.arcticsilver.com/arctic_silver_instructions.htm.**

Hose clamps

The use of stainless steel hose clamps rather than cable ties is strongly recommended. Hose clamps provide flexibility of adjustment and ease of removal. Make sure the orientation of the clamp screw tightening mechanisms for all parts of the water-cooling system are placed so that they can be easily adjusted when the final placement of parts is completed. The hose clamps should not interfere with tightening of the water block retaining screws. It is important that all the clamp adjustment screws can be reached for adjustment after the system is completed.

Building the system

Water-cooling starts in the BIOS of your computer. The BIOS contains an insurance policy in the thermal management section, which allows shutdown if safe temperatures are exceeded.

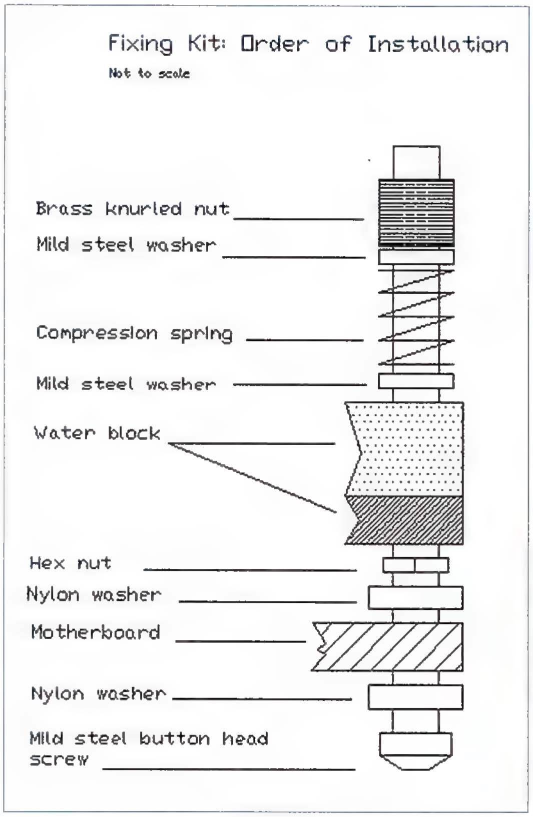
You will find the software optimistically named PC Health, Uguru (ABIT boards) or something vaguely relating to heat management. Search around in the BIOS until you find the section that determines temperature management.

There are two parts in the software that need attention, namely the temperature warning and temperature shutdown sections. Set the warning temp to the lowest practical setting possible. Set the computer to shutdown at its lowest figure in the software settings. We use 65°C for all our computer shutdowns.

CPUs have specific thermal shutdown temperatures so aim for the lowest reported shutdown or warning temperature you can. Save the new BIOS settings and remember in your overclocking adventures in the future that if you reset the CMOS you will have to re-set the shutdown and warning temperature settings.

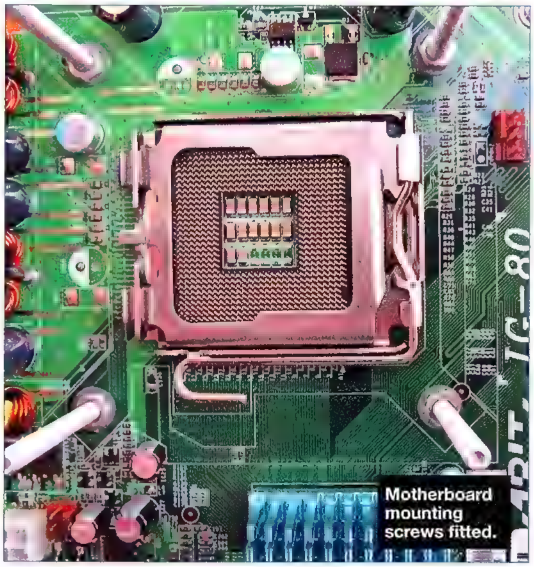
Motherboard setup

Installing water-cooling usually involves fitting hardware on the motherboard mounting points. The type of mounting points to be fitted will vary with the CPU used. Generally speaking, you will need to remove the motherboard from the case for this procedure. The diagram below provides a sectional schematic illustration of the typical fitting order for the components used to retain the water block to the motherboard.



Be aware you may have to remove the plastic mounting cradle used previously for fitting the air-cooled heatsink.

A motherboard with the mounting screws fitted for an Intel CPU is pictured above right.


Motherboard mounting screws fitted.

With the fixing screws fitted to the motherboard you can now move to the assembly of the parts into the case.

Assembly and installation

Place all your components in the case loosely to determine the best fit and placement. This allows a check that no components are impeding airflow or affecting other parts of the PC. Checking will reduce the amount of time spent organising your case.

Roughly measure your tubing to ensure adequate length from the components of the block, radiator, pump and so on. Leave some slack in the tubing, as it's easier to trim back than to add extra length after you have cut it. Remember the 'golden rule' of installation is: Measure three times and cut only once. This will ensure minimum wastage and reduce mistakes.

Cut the tubing with a vertical cut across the tubing, not on an angle. A good investment is to purchase a tubing cutter designed to cut tubing correctly. Loosely attach the tubing to the inlet and outlet barbs of the CPU water block. If you have followed the advice above you will have sufficient tubing to trim at the final fitting stage.

Trial fitting

Secure the tubing with clamps to the barbs on the water block and attach the water block to the

About a grain of rice worth of high-quality TIM smeared on the CPU is enough

HANDY HINT:

It is very important on some motherboards to make sure that you have the 'Auto shutdown if no fan detected' setting in the BIOS on 'disabled'. If you don't, you will sit there with your heart rate at 160bpm saying those immortal words 'Oh no! I've killed the motherboard.' Remember this or pay the price when you switch on your new water-cooled PC and nothing happens.

HANDY HINT:

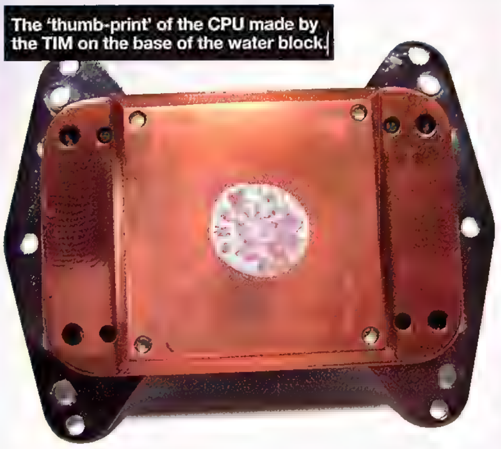
Always provide ready access to your pump when laying out the water-cooling system. That way, should you need to service the pump you won't have to remove half of your components. Avoid installing the pump in an inaccessible corner of the case, as it needs good airflow.

HANDY HINT:

Always check which of the two barbs fitted to the water block is the inlet and outlet with the water block manufacturer's manual. Water-cooling performance will be disappointing if the correct water block assembly is not followed.

motherboard. Check there is no interference with the water block and components of the motherboard. Remove the block. Fit the CPU and smear a small amount – about the size of a grain of rice – of high-quality TIM onto the CPU.

Now check the 'thumb-print' of the CPU made by the TIM on the base of the block by trial fitting the block using the mounting screws and fixing nuts. It should appear like the picture below.



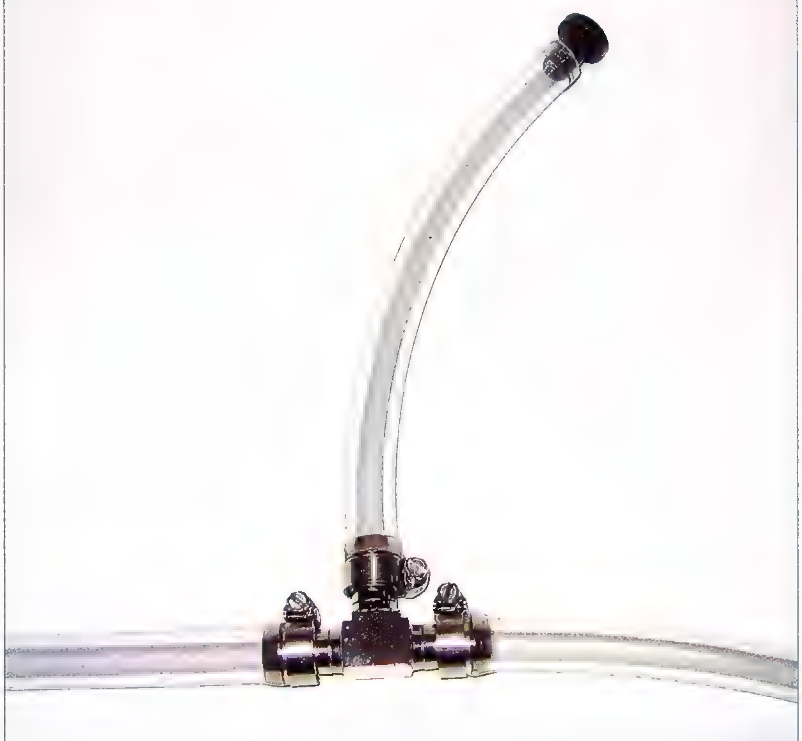
The 'thumb-print' of the CPU made by the TIM on the base of the water block.

Fitting the water block

If necessary, re-orientate the block so that the block base and TIM imprint pattern are centred on the IHS of the CPU. Make any adjustments necessary to ensure optimum placement by referring to your water block manufacturer's manual.

Replace the AS5 TIM material as per the manufacturer's instructions and then fit the water block to the CPU and tighten the fixing nuts in a 'figure of eight' rotation.

A typical 'T' line.



Tighten each fixing screw by one-quarter of a turn each time. Complete this rotation pattern until the correct number of turns has been made according to your water block manual.

Re-check hose lengths are appropriate. Re-check that there are no components interfering with the tubing clamps tightening up process. Tighten up all screws on the tubing clamps. Check all tubing to ensure there are no kinks that may impede water flow. Relieve any potential stress on components caused by bends in the tubing by undoing the tubing clamps and turning the tubing on the barb. Refit and replace the tubing clamps check the orientation and tighten.

Filling and bleeding your water-cooling system

There are a number of ways to fill your new system with coolant. If your water-cooling system contains a submersible pump, you can submerge your pump in a container of water and simply pump water through the whole system expelling the air as you go. When you are reasonably satisfied that all the air is out of the system by shaking and tilting the radiator, you can connect the tubing to the inlet of the pump while it is still underwater. This ensures that no air can gain entry to the system. It is not good practice to immerse water blocks in the coolant while filling the system. The coolant may cause oxidation and pitting of the all-important water block base.

If you have a non-submersible pump in your water-cooling system you may have to create a 'T' line.

Cost-wise the 'T' line is the most economical solution for filling and bleeding the loop. A 'T' line should always be placed in the tubing before the inlet to the pump. Filling is accomplished by adding water through the upright part of the inverted 'T'. Coolant is encouraged to flow down the tubing and into the pump inlet. When the pump and line are filled the pump is switched on, then off.

Repeatedly filling and then switching the pump on and off until the system is filled completes the process of filling. Failure to follow the switch on/switch off rule may permanently damage the pump by allowing it to run dry.

Reservoirs

Many kits contain some form of reservoir, either separately or combined with the pump in a self-contained housing. The process of filling a reservoir-based loop is substantially easier than a 'T' line-based system. While it may appear obvious enough how such a system is filled, the pump cannot be allowed to run dry. Most pumps will not tolerate even brief periods of running without coolant. Fill the reservoir, ensure no air is trapped in the pump inlet and the pump is bathed in coolant. Switch on the pump and then switch it off. Repeat with refills of the reservoir until the coolant in the reservoir no longer drops when the pump is switched on. Again failure to follow the switch on/switch off rule may damage the pump.

Leak testing

Ideally, leak testing should be conducted outside of the PC case wherever possible using a spare PSU to power the pump. In some cases, however, this is not possible due to the configuration of the system. To check for leaks in this situation, remove the water block from the CPU and place it conveniently to one side on the case floor. Placing the water block base down on some paper towelling will protect the base and provide an indicator of any small leaks as they wet the towelling. Ensure that the tubing is not kinked, fill the system and run the pump using a spare PSU as mentioned above. As a rule of thumb, leak test for a minimum of three hours – the longer the better.

> **As a rule of thumb, leak test for a minimum of three hours – the longer the better.**

Houston, we have lift-off

After bench-testing for leaks, replace the water-cooling system and all its components, re-attach the water block to the motherboard as described above. Do not forget to apply the TIM material.

Connect up all of your electrical connections to the computer power supply. This will involve connecting the pump and radiator fans to the spare PSU connectors.

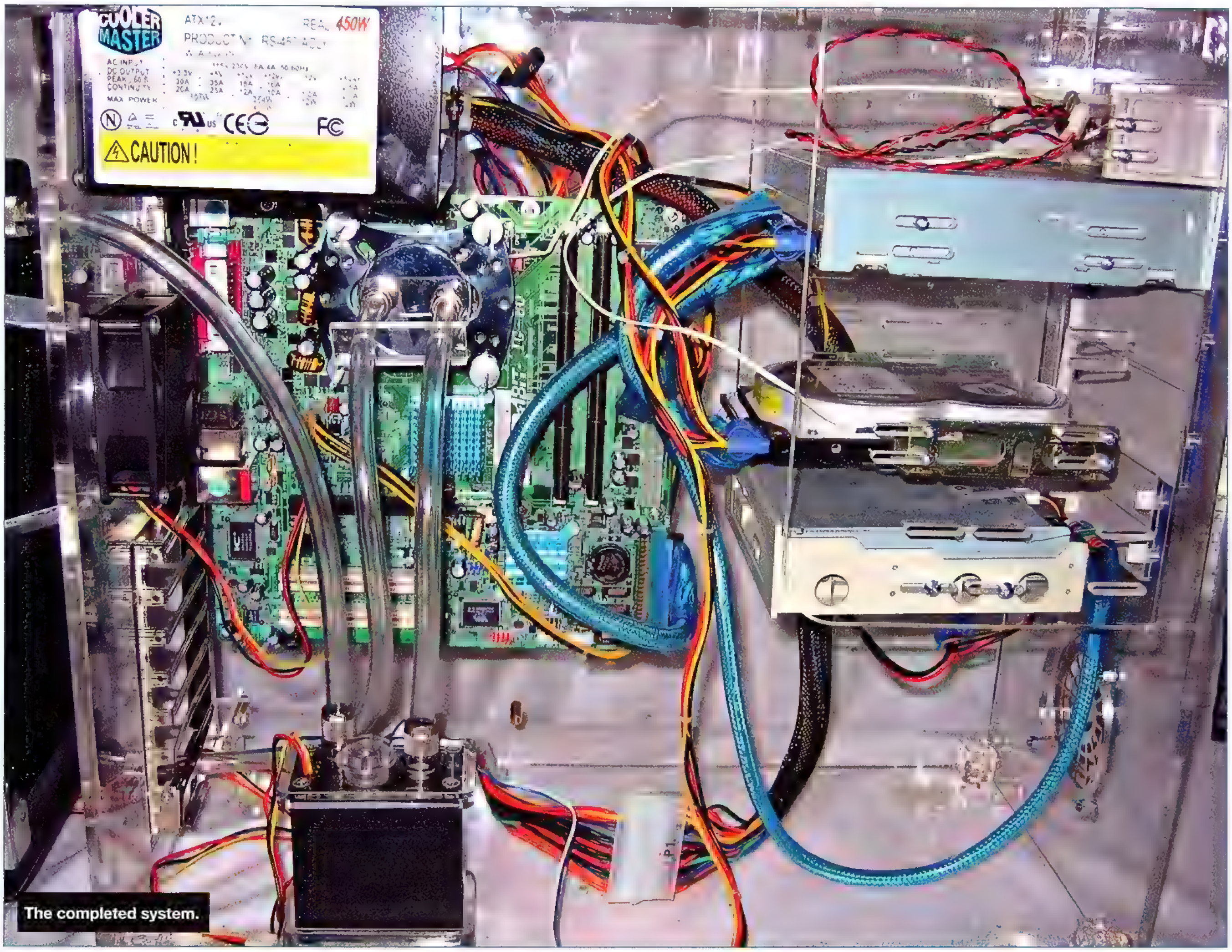
Make a final check of the fluid levels in the reservoir if you have one fitted. Depending on the pump and radiator of your choice you should have ended up with something like the picture below.

Turn on your PC and check that the water pump is working. Enter the BIOS thermal management by using the Delete key or whichever key or keys give entry to the BIOS on your motherboard and observe the temp sensor readings. A rapidly rising temperature would indicate a problem and allow for corrective action to be made. If everything seems to be stable, re-check that the BIOS temperature monitoring and shutdown temperatures are activated as previously described, and save all BIOS settings.

PC settings

It is highly recommended that after installation you run your PC at default settings for a period of three to five days to allow the TIM to cure adequately. Altering your PC settings should be carried out with reference to your product manuals supplied with your PC and it is recommended you do not do this until your system has settled in.

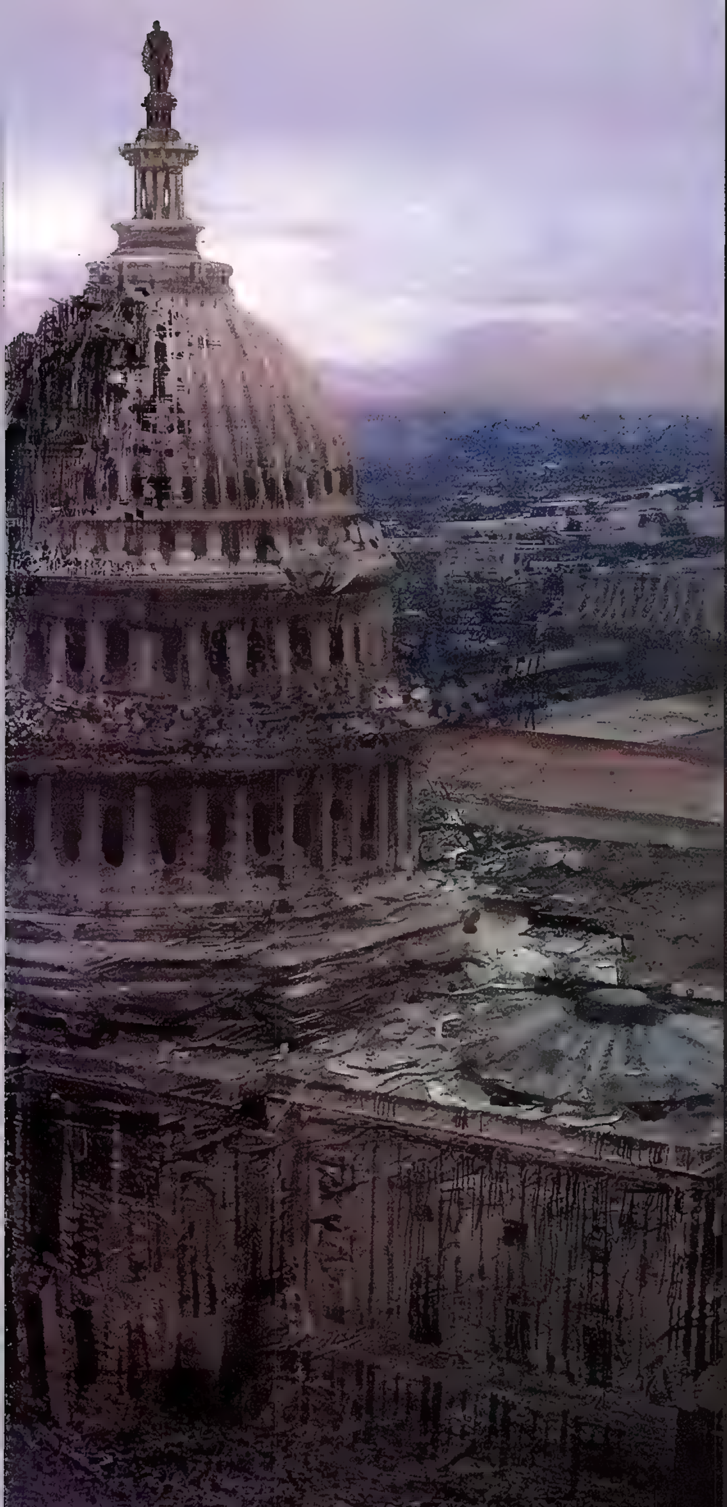
So there you have it, tips to avoid the pitfalls in water-cooling your system. We hope this guide is of some value in your water-cooling adventures.



The completed system.

A NEW, CLEAR FALLOUT

Logan Booker took his Fusion Flea Supreme for a ride to Washington DC, and the heart of Bethesda's HQ in Rockville, Maryland. Contained within is everything you need to know about Fallout 3.



10 years ago, Black Isles Studios gave birth to Fallout 2. In that time, we've come to understand a few realities of games development. For one – games have to make money.

In 2004, Bethesda Softworks announced that it had acquired the rights to the entire Fallout franchise from Interplay Productions, just a year after Interplay had cancelled Van Buren, which was to have been Fallout 3. Before Bethesda stepped in, it was highly unlikely the world would *ever* see another Fallout game.

If you've never heard of Fallout, or consider it a passing acquaintance, it was the highlight of the role-playing genre during the 1990s. Sporting an isometric viewpoint, turn-based combat, stunningly dark and ironic humour and a yet-to-be-duplicated retro sci-fi atmosphere, it had no trouble becoming an instant classic. Despite hitting it off with critics, Interplay failed to capitalise on the success commercially. If it had, it wouldn't right now be fending off creditors and selling IP to recoup its losses.

When the world found out that Bethesda was developing the next chapter in the Fallout series, the population split into two camps – those who had never heard of it but were ecstatic to discover that the mighty studio behind Oblivion was hard at work on another game; and those distraught that Interplay had been robbed of the property and some first person RPG developer was going to crank out a travesty of epic proportions.

The reality is the Fallout 3 that Black Isle Studio was slowly hammering together was not that different, at least spiritually, from the creation that is now currently drawing itself into edible form in the heart of Bethesda's HQ in Maryland, US.

Same but not

Can Fallout truly be Fallout if it is deprived of an isometric viewpoint and turn-based combat?

'It's not [because it's all we do],' explains executive producer Todd Howard, referencing the first person nature of Morrowind and Oblivion, the developer's past exploits. 'When we really went through all the options we found that if you're going to play this character and feel like you're really in this other world, nothing – nothing – is better than first person.' And immersion perfectly summarises Bethesda's approach. According to Howard, the team is doing its best to capture the feel of the first Fallout and put it to use in F3, from the characters and environments through to weapons. 'We went back and looked at Fallout 1 in particular. [It] is our model – our tone setting,' he says.

Emil Pagliarulo, Fallout 3's lead designer, agrees.

'In Fallout 2, they started bearing into too many pop culture references, too much winking at the camera. What we've found when we've tried testing the waters with the adult content [is that] it's a fine line between feeling adult and feeling very cheesy.'

Now this may come as a surprise, but this is exactly the same angle Black Isle Studios approached Van Buren with. According to the Unofficial Van Buren FAQ on popular Fallout fan site No Mutants Allowed, BIS was very particular about avoiding the 'cheesiness' of F2. Van Buren lead designer J.E. Sawyer wrote the following:

'You're not the knight in shining armour or the really evil bastard. You're in between.'

'There will be no pop culture references in any "ordinary" locations. Though there may be one or two in extremely rare random encounters. Humour is part of the Fallout setting, though its use should certainly be more like Fallout than Fallout 2.'

Howard echoes Sawyer's sentiments.

'There are some adult themes and content but the things they do in [Fallout] 2, where they reference *Monty Python*… no. *Monty Python* doesn't exist in your world. That kind of stuff is breaking that barrier for us. As far as prostitution, getting married, pimping out your wife – there's little bits of that, but not near to that level,' the executive producer states.

Van Buren was also not going to be entirely turn-based, either, with Sawyer stating that the game would need to appeal to a wider audience. From the unofficial FAQ:

'Real-time vs turn-based combat isn't an aspect of character development, but it is an aspect of gameplay. Some people don't like playing through combat, even in a good system. Some people absolutely hate dialogue, even when it's well written. To accommodate different types of players, we do need to spread our resources.'

Whichever way you look at it, Fallout 3 was never going to be turn-based only.

'There are some people that want a turn-based isometric [game], that's clearly not the game we're making,' Pagliarulo says. 'I had this epiphany and came to terms with it.

'For this small core group of people, if they don't want to like it, there's nothing I can do. I understand where they're coming from, but you can't let it cloud your decisions.'

Preparing for war

Howard says that Fallout 3 will be set 30 years after the end of Fallout 2. The location for the game has moved from California on the west coast of the US, to the east coast state of Maryland and the city of Washington DC.

As has been mentioned, Fallout 3 will mainly draw on Fallout 1 for its inspiration, with Fallout 2 and the series' various spin-offs taking a back seat, or not being referenced at all.

'When we do games we don't like people to feel like they need to have played the previous ones,' says Howard. 'We like to have lots of nods and have the lore make sense. As far as Tactics and Brotherhood of Steel, we pretty much ignored their existence,' Howard says.

The team has also had little to no contact with the developers of the previous games. Obviously Bethesda has communicated to a degree with Interplay, but as for the creative and programming minds from Black Isle Studios, which found themselves at places ranging from Obsidian Entertainment

The PIPBoy Not only is it useful, it is right there on your arm!

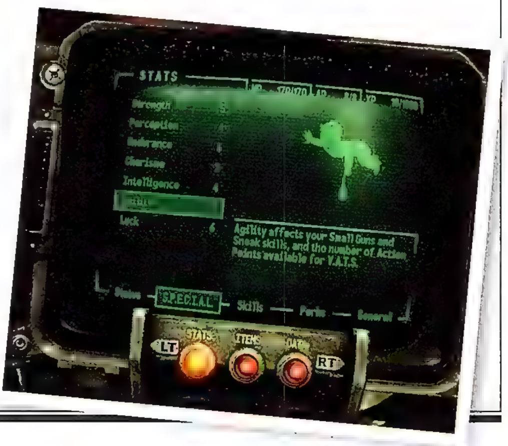
The PIPBoy is the centre of a player's life in the world of Fallout. It keeps track of quests, statistics, skills, character health and other tidbits. If there's one place Bethesda has outdone Black Isle Studios, it's the attention to detail on the PIPBoy.

'We spent way too long on this feature,' says Howard. 'Our joke is that this has more pixel shaders running on it than all of Oblivion. We really felt this was an iconic thing for us.'

The screen whirls. The buttons all work and make heavy, mechanical clicks. The terminal-green styling of the interface is tasty, and there's even something new – a radio receiver.

'Your PIPBoy also works as a receiver. So when you're walking around you might pick up a signal out in the wasteland.'

Players can tune in to a few fixed channels, such as the Galaxy News Network, which not only plays some 20 songs from the 1940s, all licensed and legal, but also reports on the player's activities – if they warrant the attention.



Agility affects your Small Guns and Sneak skills, and the number of Action Points available for V.A.T.S.

to the now-defunct Troika after the fall of its parent company, Howard admits dialog has been scarce.

'Anybody who called us to talk about it or say they wanted to be involved I talked to – so it's kind of not fair for me to get in to who exactly I've talked to. But people who have worked on the previous games, there's a number I might have talked to. I will say the key people [Leonard Boyarsky, Feargus Urqhart and Chris Avellone] I never did talk to.'

Fallout 3 is, essentially, Bethesda's blank canvas – its chance to paint its way into the legendary franchise.

In the beginning

'We started [Fallout 3] while we were doing Oblivion, kind of a small crew, doing concepts and trying out tech. Oblivion was kind of our first try at doing so many new things on next-gen platforms and PC,' says Howard

Of this, there is no denying. After awaking in the confines of Vault 101, the game's starting area, it is difficult not to compare the feel of F3 with Oblivion. Both games use Gamebryo; character dialog is handled in a similar manner; and people move in the same way. Yes, Vault 101 might as well be the opening dungeon in Oblivion with sci-fi touches.

Despite the obvious hard work Bethesda has put into the art and atmosphere, it doesn't have the ambience of the Fallout we know. The main suspect? The first-person view.

But let's put our doubts aside for now. We asked Howard why the team decide to start proceedings in Vault 101: Why not Vault 82 or 93?

'We actually did mix around with a few numbers, ones that we found sounded neat when you said them [or] sounded a bit more important than say "Vault 57",' he explains. 'I mean it's probably a bad answer – but we liked how [101] looks. We drew a bunch of suits with different numbers. The 101 on the back, even though it's a number, it's an iconic graphic. But believe it or not, we did deliberate the number, what kind of felt right, what felt important.'

Much like Oblivion's first 30 minutes, Vault 101 serves as a one hour-long character generation screen. The game begins with the player being born in the Vault, and it is at this stage one can customise the appearance of their character.

'Your dad presides over your birth. They show you a "gene" projector, what you're going to look like when you grow up and that's when you make your character,' explains Pagliarulo.

Fast forward to age one. Although Howard was light on the details, it appears at this point in the player's life, SPECIAL stats are chosen.

When you hit 10, a limited skill selection phase takes place, in the form of a birthday party where you can, apparently, pick a BB gun as a present to signify your interest in weapons. Again, Howard did not show us this part of the game or elaborate on specifics, so we can't say if this is when you spend points to boost skills or select 'tagged' skills that improve at a faster rate than normal, à la Fallout 1 and 2.

The next stage of character generation occurs at 16, where you're forced by your father to take the GOAT, or Generalised Occupational Aptitude Test. No example was provided by Howard, who skipped past this section during

Give it to me straight, Doc

A diehard Fallout fan just after the details? Here's what you can expect.

✗ **Isometric:** *Out.* Having experimented with various options, Bethesda decided that the best way to immerse the character in the world is from a first person perspective. However, Bethesda has included a solid third person mode that can zoom to an almost isometric view. However, in our opinion, a good game should be able to be immersive regardless of the viewpoint.

✗ **Turn-based combat:** *Out.* In its place is the Vault-Tec Assisted Targeting System, the specifics of which you can read about on page 38. It's pseudo turn-based. But not.

✗ **West coast and the New California Republic:** *Out and maybe out.* Fallout 3 will be set in Washington DC, on the east coast of the United States. Considering the NCR has the word 'California' in it, we can be reasonably confident it's out, but obviously not 100 percent so.

✓ **Brotherhood of Steel:** *In.* During the preview, we met up with a BoS squad and took down a bunch of super-mutants. The intro and teaser also show what is, quite obviously, a suited BoS member.

? **Sulik, Dogmeat and others:** *Maybe.* Todd Howard would neither confirm nor deny the inclusion of characters from the previous games, and with the change of location, you won't be visiting Vault 13 or New Reno either.

✓ **SPECIAL, perks, skills and traits:** *In to all.* Bethesda will be including all SPECIAL stats, a number of old and new perks, 14 of the original 18 skills and traits/titles based on your actions in-game, your level and your Karma.

? **Random encounters:** *Maybe, but likely out.* Howard gave the strong impression that, while there would be a fast travel mode at some point, it was unlikely there would be random encounters. So no photos of Elvis or phasers folks – and no Outdoorsman skill either, we're guessing.

✓ **Stimpaks, Mentats, Rad-Away:** *All in.* Bethesda will remain faithful to the drug-heavy flavours of the Fallout we know. In fact, during the preview, Howard swallowed a Mentat to boost his Explosives skill.

? **The Bozar (and other awesome weapons):** *Maybe.* While we didn't see any weapons of old, we were given a look at the .22 Hunting Rifle, the Chinese Assault Rifle, a laser rifle from the BoS and the 'Fatman', a portable mini-nuke launcher. You can even assemble weapons from scavenged parts – the Rock-It Launcher for example can fire pretty much anything you shove into it, and a bomb can be made using explosives, a lunchbox and bottle caps (which are also the in-game currency).

✓ **Bottle caps as cash:** *In.* Confirmed above in detail.

✗ **References to *Monty Python*, etc, and breaking the fourth wall:** *Out.* Howard was very clear on removing 'cheesiness' from the game. Depending on your tastes, this could be a good or bad thing.

✓ **Gore and violence:** *In.* To quote Howard, 'Violence – people forget that Fallout was one of those first games where you [were] like "Look at the violence!" Violence is funny. Violence, done well, is hilarious.' This was evidenced by an eyeball we saw fly from an exploding head.

✓ **Radiation:** *Most definitely in.* Like previous games, taking in too much radiation will reduce statistics and eventually kill you. In-game it's used as a balancing mechanic; you can drink water to regain small amounts of health, but if it happens to be out in the wasteland, chances are it'll be irradiated.

✗ **Groin-punching:** *Out.* Bethesda has reduced the number of body parts that can be targeted to the head, torso, weapon, legs and arms. In the case of animals and mutated creatures, these will differ.

✓ **Team-mates:** *In.* You will be able to hire mercenaries, but your control over them will be restricted, much like it was in Fallout 1. 'We don't envision having you walking around with four other guys,' says Howard.

And for those coming from the opposite end of the pool, what will Fallout 3 share with Oblivion?

? **Modding:** *Maybe, but looking out.* 'We don't know yet,' says Howard. 'We've certainly been successful with Oblivion. We don't take that for granted. It's something that we're still thinking about, but we don't know yet.'

? **Xbox 360 interface on PC:** *Maybe, but should be out.* Bethesda is well aware of the fact that the PC interface for Oblivion was, to put it simply, a pile of crap. According to Howard, Fallout 3 will feature a larger interface font than Oblivion, which he says was the main contributor to the problem. Nothing is finalised, however.

our preview, but we were given the impression it was an opportunity to round off skill selection and even tick off a few traits and perks.

Finally, the player hits 19 and discovers that his father – his only surviving relative and guiding force in the world – has left the Vault. This is an unheard of event in Vault 101 life (see Conflict forever constant, page 37).

Ultimately, the quest to find the player's father serves as the main story of the game – not willing to spend the rest of their life in the steel corridors of the Vault, wondering what the hell happened to Dad, the player takes matters into their own hands, cracks open the Vault doors, and braves the harsh wastes of the outside world. It is here you'll cop the last part of character generation – a summary page. This screen will serve as your final chance to make changes to your character, and according to Howard, will cover everything from SPECIAL stats to skill selection.

Over the course of what can only be described as a triathlon of character generation, the player will be prompted to complete quests that alter Vault life as you grow older. One example given by Bethesda was standing up to a group of bullies, which would change their attitude towards you and others as you age.

While there is something to be said for immersion, we found the extended nature of the character generation off-putting, to the point where experimenting with character types would be a punishing affair.

'It really guides you in terms of who you want to play and how things feel, and that's part of the reason we do it there,' says Howard, in regards to Vault 101's endurance-based character gen. 'We draw it out partly because we want that Vault experience to feel like it's you growing up. It's not like you're not playing the game – it's not some glorified character creation screen – you're doing quests and other things.'

Venturing out

Washington DC is about as dead as a city pelted with nuclear weapons can be. On exiting Vault 101, the player's vision is blurred, the natural light of the sun a foreign experience. Apart from the rocky ground and sparse plant life, vague landmarks are visible in the distance – what looks like a fuel station, a bizarre-looking vehicle and, to the far right, a hub-like structure.

'It's not quite as big [as Oblivion], but the scale is different,' says Howard in regards to the size of the game world. The map itself is a big square, with 25 percent of the space taken up by Downtown DC – itself located in the bottom right corner of this square. The other 75 percent was described as 'The wastes'.

'It is all open for you to explore, to go wherever you want and do whatever you want,' says Howard.

In order to progress though the game, the player will need to complete certain sections, primarily to feed their growing understanding of the whereabouts of their father. Bethesda has tried not to 'lock down' particular areas or throw up scenarios that force the player in one direction, but there will be the feeling of an omnipotent hand standing ready to politely shuffle you down the right path.

Alongside the questing component sits a Karma system that reflects the morality of the player's character. What Fallout 3 offers in contrast to its predecessors is that in addition to good and evil choices, players can morally sit on the fence.

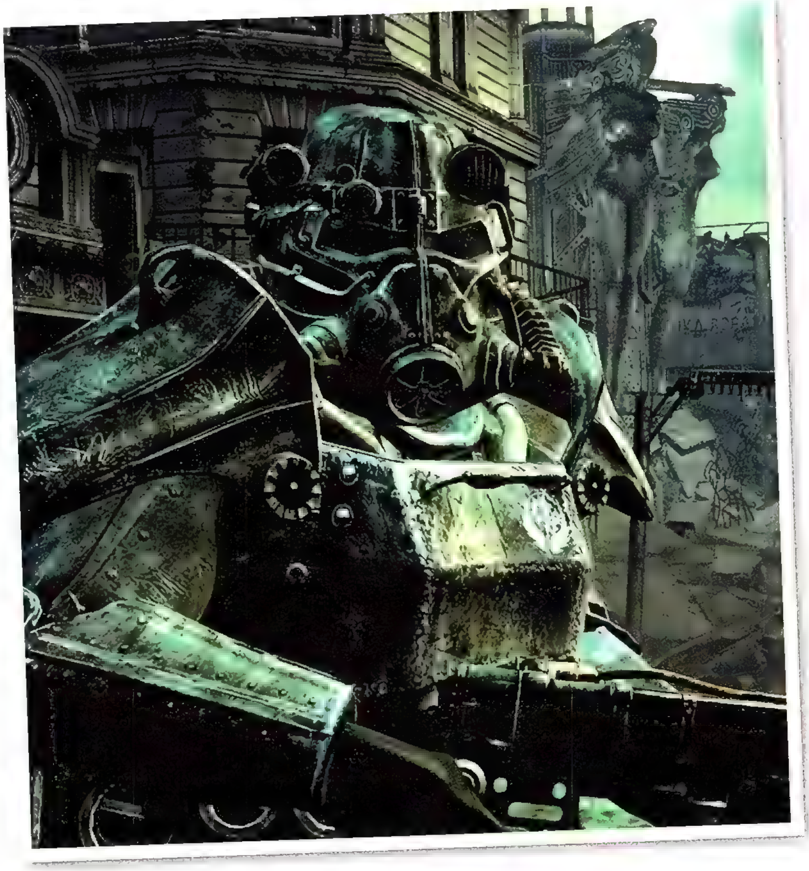
'You can play in that grey area,' explains Pagliarulo. 'So you're not the knight in shining armour or the really evil bastard. You're somewhere in between.'

According to Pagliarulo, the team has gone to great lengths to make this the case throughout the entire game.

Howard during the preview was more than happy to provide a demo of the system in action. The hub-like structure we mentioned earlier actually turns out to be a small town called Megaton. It's built out of the skeleton of a downed airliner, and constructed inside the crater of an undetonated nuclear bomb. The citizens of this fine locale worship the device, believing it to be a sign from God.

Your first encounter within the town – apart from the crazy robot at the entrance that assesses your threat level, an emasculating 'minimal' – is the sheriff, Lucas Simms. He takes no time in laying down the law, and the manner in which you respond to his authority will determine his future – and that of others in the town – and whether he'll offer you quests or ignore you outright.

Further on in the town is a small bar, located a few levels up in the compact, but rather tall confines of



Megaton. A mysterious figure, who introduces himself as Mr Burke offers you a job to set off the nuke in the middle of town, which isn't so dead after all.

Pagliarulo says that you're free to take the situation back and forth between Burke and the sheriff. If you play it nice with Simms, he'll even give you a quest to disarm the nuke. Ultimately it's left to you to save or condemn the entire town.

What does that mean in real terms, exactly? Let's just say Howard decided it'd be cool to blow the town up. From a safe distance he flicked the switch on the remote detonator, and the explosion, which occurred in real-time at Megaton, frothed upwards in the typical mushroom-cloud style, wiping the tiny city off the map and irradiating its surrounds for the rest of the game.

Gone, in an instant, were 20 or so hand-crafted NPCs, their associated quests, equipment vendors, the sheriff – everything. And it is quests like this, and their conclusions, that will decide what sort of character you play.

'I'm not going to go out and say you can wipe cities of the map, but the [dilemmas] are of the nature of who you are going to side with or who you're not going to side with,' says Howard.

Experiencing the next level

Core to Fallout, and any role-playing game, is levelling. Along with the quests and the main plot, achieving that next step in your character's progression is half the fun, or at least, one-third of it.

According to Howard, most players will gain experience – the food for the levelling monster – by completing quests, though killing creatures will also reward a small packet of points. Each even level – rather than ever third, as with previous Fallouts – the player will be able to choose a perk. Perks provide the player with a way to make their character unique and to flesh out their specialities. With the maximum level being 20, players will get to pick a total of 10 perks.

What perks will be available is up in the air at the moment, but there was one related to eating corpses that Howard was sadly reluctant to talk about. A statistic informing the player of how many cadavers they'd feed on appeared on the load screens during the demo, but that's all we know.

Pagliarulo couldn't provide an exact figure on how long it would take to climb the level ladder, but did mention that they will be balancing it so the stuff you get at 20 isn't meaningless.

We have the technology

One could view Morrowind and Oblivion, and their numerous expansions, as the cautious run-up to the leap that is Fallout 3 as far as the game engine goes.

'We announced we had the rights [to Fallout] in 2004, before we announced Oblivion. So that was weird for us. We knew these games were going to share tech,' explains Howard.

Starting with middleware developer NDL's NetImmerse for Morrowind, and then moving to the thoroughly malleable Gamebyro, NetImmerse's successor, Bethesda has, slowly but methodically, improved its expertise with the technology. By its own confession, Fallout 3 is very character-driven, and has demanded more attention to detail than any of the developer's previous titles. 'Every single pixel shader – our basic diffuse lighting, even the shader for that – was tweaked,' says Howard.

The current incarnation of Bethesda's Gamebryo represents one of the most potent game development platforms in the industry today, rivalling that of Epic's Unreal Engine 3. It not only comes with renderers for the PC and Xbox 360, but with the recent completion of the PS3 version of Oblivion, it packs in the sidelines a powerful renderer for Sony's next-generation console as well.

'We haven't got new code from them [Emergent] since before we finished Oblivion,' says Howard. 'A lot of what we've done with it is really tweaks for our kind of games.'

'At this point now, most of the tech we're running on is all ours. Even though we used Gamebryo in Oblivion, all the shaders, lighting, all of that is ours. It's a very nice system, it's also very

flexible. If we want something in there we just do it ourselves.'

A few of those new somethings for F3 include pixel shaders for depth of field, motion blur and film grain, and new, superior water shaders that permit true reflection and refraction of the environment. Howard also mentions that sub-surface scattering has made its way into the technology, allowing for the computation of effects based on the interaction of light with skin.

On a vertex level, Bethesda has added decal meshes, which make use of parallax occlusion mapping, to flavour the wastes of DC with buildings and terrain that look, literally, like a bomb hit them.

'We had to push the technology we have for Oblivion even further. One of the things we [had to solve] for Fallout is how we render destruction. And I mean lots and lots of destruction,' says Howard.

Essentially, deformed meshes can be planted into a scene by an artist, to add just the right amount of post-apocalyptic decay or, if the player so wishes, dynamically by the rounds of a rifle or shotgun. Note that these effects are purely cosmetic – players won't be tearing up Washington DC Red Faction-style.

Despite what sounds like a hotbed of graphics glory, PC users will not have to shell out for DirectX 10, and as a consequence, Windows Vista, for the right to experience these visuals. Howard, although non-committal on the subject, made it clear he wasn't overjoyed by the prospect.

'I am not of the opinion of requiring Vista to run this game. I think it's bullshit,' he says. 'DirectX 10 mostly gives you, not really a feature set – they [Microsoft] like to tout it that way. It does things better – definitely does things much better, higher, faster on the PC. But it's up in the air what we do.'

Gamebryo's procedurally-generated content has also seen an overhaul, specifically the face generation technology Bethesda licensed from Singular Inversions for Oblivion.

'You look at the faces in Fallout – it's the same system. This is just how we do it better,' says Howard, who credits rewritten shaders for providing the improvement.

Finally, let us not forget Oblivion's Radiant AI – a much-vaunted feature that, in practice, had little impact on the game. Bethesda remains adamant that Radiant is a powerful system and, with the experience of Oblivion under its belt, Fallout 3 will show off more personable NPCs.

Conflict forever constant

Fallout is famous for its narration, particularly the words 'War. War never changes', spoken during the opening cinematics of Fallout 1 and 2. Actor Ron Perlman, for both games, had the honour of delivering this haunting, unforgettable line of prose, and with the isometric view and turn-based combat banished from Fallout 3, Bethesda made sure to secure the vocal services of Perlman for the third outing.

For your reading pleasure, we've included the entire opening monologue from Fallout 3's intro. It's a spoiler of sorts, so if you'd like to keep your F3 experience as untainted as possible, cover your eyes.

'War. War never changes. Since the dawn of human kind, when our ancestors first discovered the killing power of rock and bone, blood has been spilled in the name of everything, from God to justice to simple, psychotic rage.

'In the year 2077, after millennia of armed conflict, the destructive nature of man could sustain itself no longer. The world was plunged into an abyss of nuclear fire and radiation. But it was not, as some had predicted, the end of the world. Instead, the apocalypse was simply the prologue to another bloody chapter of human history. For man had succeeded in destroying the world – but war, war never changes.

'In the early days, thousands were spared the horrors of the holocaust by taking refuge in enormous underground shelters known as Vaults. But when they emerged, they had only the hell of the wastes to greet them – all except those in Vault 101. For on that fateful day, when fire rained from the sky, the giant steel door of Vault 101 slid closed... and never reopened. It was here you were born. It is here you will die because, in Vault 101, no one ever enters, and no one ever leaves.'

According to Howard, Oblivion had some 1500 NPCs, all of which had to be accounted for when building Radiant and implementing behaviours. In comparison, Fallout 3 will pack just a few hundred.

'So far we've been really successful at making every person you see in the game a unique individual. They're not walking information kiosks, they feel like real people as much as we [can make them],' says Pagliarulo. 'On the design side, that's been one of our biggest goals.'

End of the world as we know

In a departure for the series, Fallout 3 will be released simultaneously, and worldwide, on PC, Xbox 360 and PS3. Each platform is equal in the eyes of the developer, although Howard admits that the 360 often receives new code first.

To compare Fallout 3 with the other two games in the series, it's hard not to wonder if the huge departure in format will negatively impact the game. Is Bethesda appealing to the lowest common denominator?

'There's so much derivative crap out there – [Fallout] is different enough,' says Pagliarulo. 'As someone who is a creator, you want to reach as many people as possible. You want as many people as possible to play your game. That's really the most important thing. Hopefully because of the success of Oblivion – Oblivion put Bethesda on the map – I'm hoping that simply by virtue of that, we get fans and impress them by the next thing we're doing.'

With a couple of successful games in the trophy room, the odds are with Bethesda. Then again, it's never been at the mercy of one of gaming's most passionate and highly critical communities. And as far as that community is concerned, the war may not have changed, but everything else has.

The Vault-Tec Assisted Targeting System for Dummies

VATS, simply, is pausing with style. The player can stop the action, assess an unfolding bloodbath, and queue attacks targeted at specific body parts. Queuing attacks costs Action Points, or APs, and once depleted the player will have to wait for them to recharge in realtime.

Fallout 3 will include a complete damage model, so leg injuries will cause enemies to limp and shots to the head will blur their vision. The player is also affected by this damage model and can sustain similar disabilities, which are detailed via a simplified anatomical Vault Boy diagram accessible through their PIPBoy.

'All that stuff is actually happening in real-time,' explains executive producer Todd Howard. 'But the VATS system allows you to really play it. We don't want to necessarily reward twitch play, we want to reward role-playing your character well.'

Currently, VATS is the only element of combat that involves APs. The player can regenerate APs quickly by fighting conservatively; according to Howard, firing one's weapon constantly will impede AP recovery, with Agility determining the base rate at which this occurs.

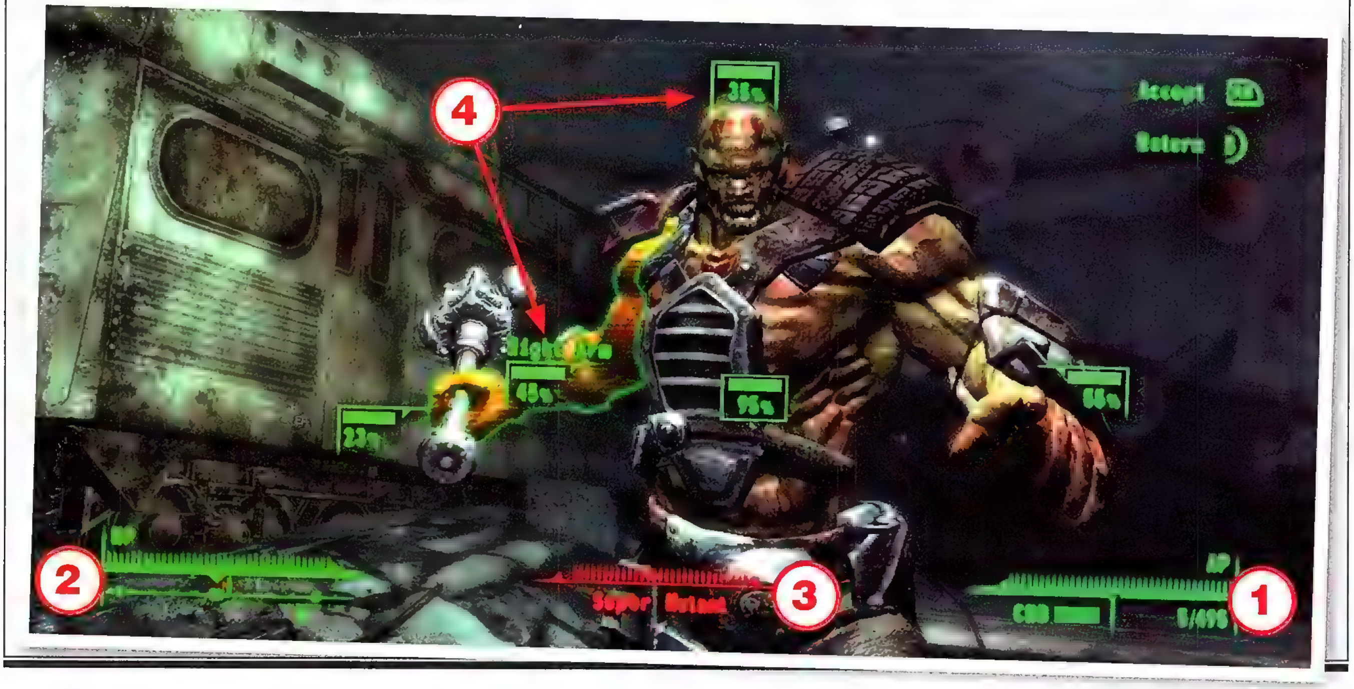
Don't be surprised if this concept sounds familiar – the Micro Forte-developed spin-off, Fallout Tactics, and its 'Continuous Turn-Based' combat mode, shares the same mechanic, as did Black Isle Studios' cancelled Van Buren.

'There are plenty of role-playing games and plenty of first-person RPGs that have had FP RPG combat – Vampire: Bloodlines, Deus Ex – but we knew we really needed to do something different,' explains lead designer Emil Pagliarulo. 'We went back and forth – what should VATS be? Should it be slow-motion or some really cool bullet time thing? Ultimately what it comes down to is, we knew it needed to be paused and [give you the] chance to think tactically.'

Despite this, Pagliarulo says the player is free to 'run and gun the whole game', ignoring VATS entirely. Skills will still determine how well you can hit something though, no matter how uber you might be at Counter-Strike.

'There is spread,' says Pagliarulo. 'Your skills affect how much the gun waivers. If you had a low Small Guns skill and a hunting rifle, if you got right on top of them you wouldn't need to go into VATS to cap him a few times. If there's a super-mutant 20 metres away, shooting at you with dead-on accuracy, and your skill is low, the chance of hitting him is pretty small.'

1. **Action Point gauge: A visual representation of the player's reserve of Action Points. The player can queue, and execute, attacks as long as they have APs. Once this supply is exhausted, VATS becomes a glorified pause button.**
2. **Player's health gauge: The character's health, shown as a lovely green bar. Obviously, as you take damage, this goes down and when it hits zero, you'll die.**
3. **Enemy health gauge: Just like the player, enemies can take a certain amount of damage before they die. Aiming for critical areas (*see 4*) will expedite this, especially if you go for the head. It is possible to score critical hits in real-time as well.**
4. **Critical areas: Depending on the enemy you're fighting, you'll be able to target various critical areas on their person. For most though, these areas will be the head, arms and legs. A green bar shows the 'health' of each body part, while a percentage number represents the chance of hitting that area. This percentage is calculated using the appropriate weapon skill and the player's Perception stat. Held weapons can also be targeted.**



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HARDCORE

NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

This month saw a new dawn for technology and *Atomic* alike. There has been a changing of the guard with Craig Simms moving on and the new kid on the block, Josh Collins, moving in.

Keeping the trend rolling, the Gigabyte GA-P35T-DQ6 entered labs, as did sexy new high-performance DDR3 in the form of the Kingston PC3-11000.

We enjoyed the company of Hitachi's latest storage terror, the 1TB Deskstar 7K1000, as well as another widescreen LCD – the AOC 210V. We also took a close look at the world of budget cases with a roundup of sub-$150 offerings – we found the good, the bad and the surprisingly awesome. And Dan goes on an insightful rant on the methodology behind the game save.

HARDCORE CONTENTS

How we test 42

Head to head: Budget case roundup 44

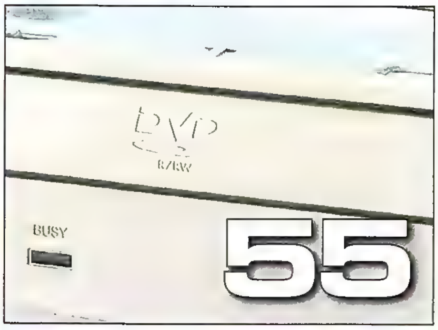
Gearbox 50

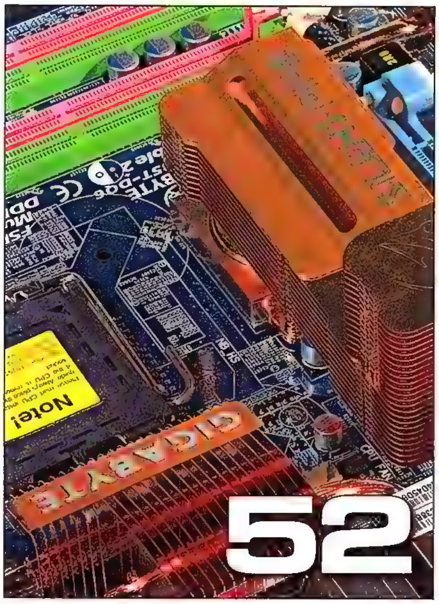
Kitlog 58

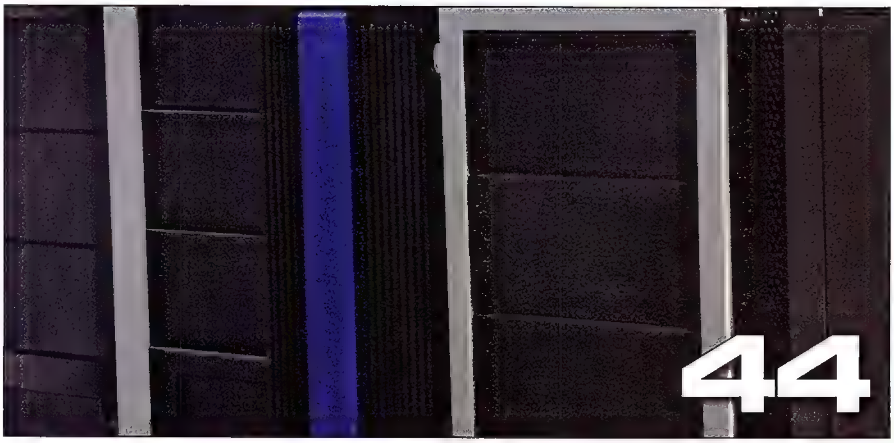
Ground Zero 60

Hardware Reviews:

Gigabyte GA-P35T-DQ6 52
Kingston HyperX PC3-11000 53
Thermaltake Tough Power 1200W 53
MSI P6N Diamond 54
Hitachi Deskstar 7K1000 55
Pioneer DVR-212 55
AOC 210V 56
Cooler Master Real Power M1000 56







BENCHMARK

How we test,
what we test,
when we test it

3DMark05 and 06 are the legs of our bench. As freely downloadable tools, they allow people all around the world to compete on a single platform, regardless of its indication of real world application, and its ability to keep our table stable.

On the gaming surface, Call of Duty 2 takes first honours in the FPS department. Quake 4 follows closely behind for our OpenGL benchmarks, taking over from where the venerable Doom 3 left off and offering multiple CPU optimisations. Half-Life 2 remains, its market penetration simply too huge to ignore. X3: Reunion makes an appearance, in an effort to have a benchmark that is not an FPS. In the same line, Splinter Cell: Chaos Theory has also been added. Other games do exist. Honest.

All tests are run at 1280 x 1024, 1600 x 1200 and 1920 x 1200 with vsync off, to cater for the most popular LCD resolution, CRT resolution and those who own widescreen monsters respectively.

To hit the CPU, we use LAME MT, a multithreaded version of the popular MP3 encoder, which is used to compress a standard 30-minute WAV file. Similarly, VirtualDubMod is used to compress a standard 1GB raw video file into XviD at 1300Kb/s. Other CPU specific tests in our stable are Maxon's CineBench and SuperPi Mod. Rounding out the suite, SiSoftware's Sandra tests several subsystems across the board, while HDTach and ATTO Disk Benchmark helpfully provide hard drive scores.

All these tests are run on a Windows XP SP2 platform, running the latest official drivers available. Every test is run three times to eliminate any oddities that may crop up along the way, the final result printed in the magazine being an average of those scores.

Of course, all this is pointless without a standard set of hardware, and as such it is laid out below for the world to see. On with the testing!

The *Atomic* Hot Award is given only to the best. In our roundups, we differentiate the best further using the following awards:

VALUE AWARD This means the product is the best buy price-wise.

PERFORMANCE AWARD Price isn't a big factor – it just has to make our benchmarks burn and our eyes water.

EXTREME AWARD Forget everything. If it's *mind-blowingly amazing*, then it'll get an Extreme Award.

BENCHMARKS

Graphics

3DMark05
Game tests only, 4xAA, 8xAF
www.futuremark.com

3DMark06
Game tests only, 4xAA, 8xAF (SM2.0), 8xAF (HDR/SM3.0)
www.futuremark.com

Half-Life 2
Canals custom timedemo, 4xAA, 8xAF, all details highest, HDR off
www.half-life2.com

Splinter Cell: Chaos Theory
Lighthouse Demo, Shader Model 3.0, 8xAF, shadow resolution high, all features on
www.splintercell3.com

X3 Rolling Demo
High settings, auto quality control disabled, glow enabled, 4xAA, 8xAF
www.egosoft.com/games/x3/info_en.php

Call of Duty 2
Hill 40 – Defend custom timedemo, 4xAA, 8xAF, all options highest
www.callofduty2.com

Quake 4
High quality, 4xAA, 8xAF, Multiple CPU support, all options highest
www.quake4game.com

Subsystems

HDTach
www.simplisoftware.com

LAME MT
softlab.technion.ac.il/project/LAME/html/lame.html

VirtualDubMod
virtualdubmod.sf.net

SuperPi Mod
www.xtremesystems.com/pi

Cinebench
www.cinebench.com

SiSoft Sandra
www.sisoftware.co.uk

Everest
www.lavalys.com

Others

DisplayMate
www.displaymate.com

ATI Tool **www.techpowerup.com/atitool**

RivaTuner
www.guru3d.com/rivatuner

FRAPS
www.fraps.com

CPU-Z **www.cpuid.com**

Stress Prime 2004 Orthos
sp2004.fre3.com

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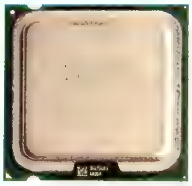
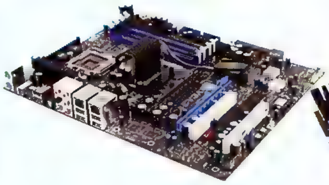
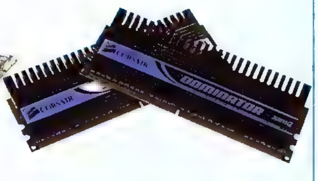


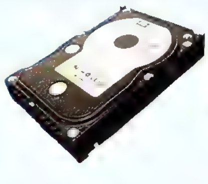
▲ Intel Core 2 Duo X6800



▲ EVGA 680i SLI

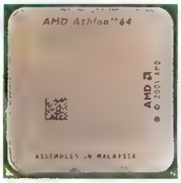


▲ 2GB Corsair Dominator PC2-10000

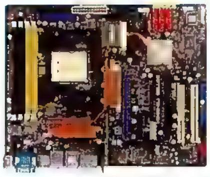


▲ WD 1500ADFD

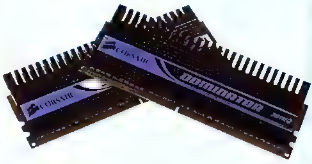
▲ Enermax Galaxy 1000W



▲ AMD Athlon 64 FX-62



▲ ASUS M2N32-SLI Deluxe



▲ 2GB Corsair Dominator PC2-10000

▲ Dell 2405FPW

▲ ASUS 8800 GTX

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	Umart International	02 9745 0877	www.umart.net
SA	Adrenalin Computers & Software	08 8410 0777	www.adrenalin.net.au
	DIY I.T. Supply	08 8340 8090	www.diyit.com.au
	IT4US Computers & Media	08 8231 7588	www.itforus.com.au
QLD	Computer Alliance	07 3421 3200	www.computeralliance.com.au
	Game Dude Computers	07 3387 1500	www.gamedude.com.au
	Dreamworks IT	07 3396 0544	www.dreamworks.com.au
	Umart Online	07 3369 3928	www.umart.com.au
WA	Austin Computers	08 9201 2788	www.austin.net.au/index.asp
	Trinix Computers	08 9350 1600	www.trinix.com.au
	YNOT Computer Systems	08 9330 7666	www.ycs.net.au

BUDGET PC CASES

Josh Collins is a complete head case, but he also knows his way around a box. Let him tell you which are the best.

Expensive, high-end cases are an unnecessary luxury for those on a budget. The cash saved by forgoing a $400 super case is better invested in superior go-fast components.

And there are a number of very appealing cases available in what we call the 'Budget' category. Regardless of how much you have to spend, you should still demand and expect a quality exterior.

So what is a budget case? We've defined this as being a sub-$150 box of any shape or form factor. So, we've brought together an assortment of midi-towers and micro-ATX cases. Whether you're scouting for the next budget home server, looking for a container for the system that provides your gaming ecstasy or you crave the concept of constructing a micro-PC for easy LAN party portability, there's something here for you.

How we tested

Throughout our testing we followed a list of criteria that the cases were marked against. For your reading pleasure, and because we reckon it's a good idea, here's that list:

- Price
- Fascia
- Cooling
- Drive space availability
- Interior space
- Aesthetics
- Restrictions
- Weight
- Design
- Construction

Could have been a contender?

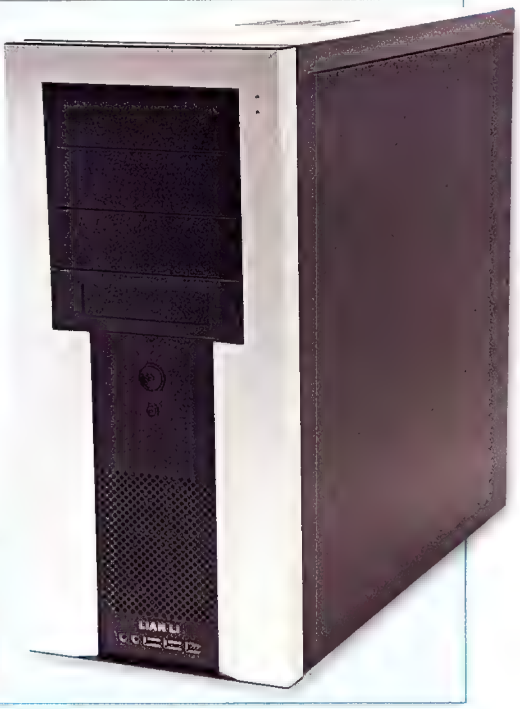
We extended an open invitation to manufacturers to provide samples for review. Unfortunately some samples did not meet the deadline and therefore were not included.

However, at *Atomic* we understand that readers are well aware of other options out there from manufacturers such as Thermaltake and Cooler Master. As such, we'll be looking to include further budget cases in future issues, to ensure a well-rounded representation of the market.

Lian Li PC-7S

Specs **ATX and micro-ATX; 4x external 5.25" bays; 1x 5.25" to external 3.5" bay; 3x internal 3.5" bays; 2x 120mm mounts with blue LED fans; 1x 80mm fan mount; removable PSU tray; aluminium; 5.1kg; 210 x 450 x 490mm.**
Supplier **Anyware** Website **www.anyware.com.au** RRP **$148** Street price **$138**

atomic hot award



Let's just get one thing straight from the very start – this case is gorgeous. With a sleek and classy anodised aluminium fascia, it's classic Lian Li styling. Additionally, the fascia is easily detached. The power button is also classy, delivering a firm, confident click.

The cooling of the PC-7S is well considered for the size and budget of the system, sporting two 120mm fans with blue LED lighting – one front intake and one rear exhaust – and an additional mount for an 80mm fan on top. This layout offers clearly defined and simple airflow from the front of the case to the rear, with the ability to also remove hot air caught between the PSU and 5.25" bays through the top 80mm fan mount. Furthermore the inlet fan is covered with a mesh grill to help keep those horrid little breeding dust bunnies out of your system.

The PC-7S offers three dedicated 3.5" drive bays conveniently placed behind the 120mm intake fan with the potential to convert one of the four 5.25" drives into an internal or external 3.5" drive bay.

The internal design and layout includes a shroud that covers the PSU and the ends of the upper 5.25" drive bays. This shroud contributes considerably to the ability to hide cables from view and thus provide a clean and spacious case interior.

We found that the Lian Li could handle the space-devouring 8800 GTX, but only with the loss of one HDD within the 3.5" caddy, so 8800 GTXs in SLI and lots of drives is out of the question.

Weighing 5.1kg with a full array of features, this is an aluminium enclosure at it's finest. Overall the case displays an abundance of detail, quality and refinement. With all edges rolled, filed or capped with rubber C-stripping, the PC-7S is a joy to work with.

SCORE **9.5** OUT OF 10

iCute GTR QH01

Specs **ATX and micro-ATX; front PSU mount; 3x external 5.25" bays; 1x external 3.5" bay; 2x internal 3.5" bays; 3x 80mm fan mounts; 2x 120mm side fan mounts; side window; 1x 120mm blue LED fan; 2x USB 2.0; SECC steel; 5kg; 160 x 355 x 485mm.**
Supplier **AusPCMarket** Website **www.auspcmarket.com.au** RRP **$99** Street price **$99**

A relatively new entrant to the market and coming in at a price of $99, the GTR QH01 makes no attempts to hide which market segment it's aimed at. It's a budget case through and through, though it does have some interesting innovations and choice of materials.

The fascia is a metal mesh rolled over a plastic frame. Visually the fascia is relatively attractive and offers the ability to provide an easy inlet for airflow. Unfortunately the iCute's plastic construction can't help but feel a little cheap, diminishing the appeal of the case when placed next to other examples such as the Lian Li PC-7S. Arguably, this is to be expected from a case that is effectively a third of the price. The fascia also incorporates an optical drive stealth plate – unfortunately this happens to have 'DVD-ROM' printed smack-bang in the middle of the cover.

The power button is a pretty, circular brushed aluminium thing, which feels good when pressed in, but snags on the edges of the surrounding plastic guide when released. The reset button on the other hand is conveniently placed on the side of the case and does not exhibit the same issues.

For its size, the case offers many varied cooling options. One 80mm fan mount is placed on the front of the system – sadly this cannot be accessed without the removal of the front fascia – with two more on the rear of the case. The system continues with the cooling extravaganza by placing two 120mm fan mounts on the perspex side panel, directly over the CPU and GPU areas.

The enclosure offers sufficient 5.25" bays for the average user but does skimp on 3.5" drive bays. With only two 3.5" drive bays, the end user is restricted in their upgrade path choice. Even converting two of the three 5.25" drive bays to 3.5" drive bays only offers a potential four 3.5" drive bays.

The enclosure isn't that heavy – 0.1kg lighter than the Lian Li PC-7S – as it is made from SECC steel.

All up, the iCute is a nice effort, but even for the price of $99, there are a few too many shortcomings for our liking.

SCORE **5.0** OUT OF 10

Antec NSK4400

Specs **ATX and micro-ATX; 3x external 5.25" bays; 2x external 3.5" bays; 3x internal 3.5" bays; 1x 120mm fan mount with 3-speed fan; 2x 80mm fan mounts (front and side); 2x USB 2.0; 380W PSU; SECC steel; 8kg; 200 x 420 x 420mm.**
Supplier **Altech** Website **www.altech.com.au** RRP **$149** Street price **$113.60**

The NSK4400 is physically shorter then the likes of the Silverstone TJ01 and Lian Li PC-7S. They're very similar in width though. This leads to the internal layout of the NSK4400 feeling neither cramped nor spacious. With an extra 20-25mm in length, the case would also be capable of housing a long graphics card.

For ventilation, the NSK4400 comes with holes between the fascia and the face of the case structure, while front and side 80mm fan mounts, sans fans, are also available. For exhausting waste heat, there is a 120mm case fan at the rear that comes with a 120mm Antec TriCool 3-speed fan.

The NSK4400 has drive space in ample supply for a budget case. Featuring three external 5.25" bays, two external 3.5" bays and three internal 3.5" bays, this allows for plenty of future growth. However, the case is incapable of housing a monstrous graphics card such as an 8800 GTX.

The weight of the unit was to be expected as it is a midi-tower constructed completely of SECC steel. It a very solid unit thanks to this, but this prevents it from being the best choice for a LAN gaming-oriented PC.

A PSU is included with the case and is rated at 380W output. In today's market, even for a budget system, this is below acceptable. On top of this, the PSU makes use of an 80mm rather than a 120mm fan and is loudish as a consequence.

The overall design of Antec's NSK4400 is pretty decent, however it would be good to have seen an intake fan included. This oversight, combined with a rather difficult to remove hard disk drive caddy and the diminutive length, makes the NSK4400 case interesting conceptually, but a rather average product in reality.

SCORE 7.0 OUT OF 10

Silverstone TJ01

Specs **ATX and micro-ATX; 6x external 5.25" bays; 2x external 3.5" bays; 4x internal 3.5" bays; 2x 60mm mounts with fans; 1x 80mm mount with fan; 2x USB 2.0; 1x IEEE 1394; aluminium front bezel; SECC steel; 7.3kg; 193 x 425 x 475mm.**
Supplier **Altech** Website **www.altech.com.au** RRP **$139** Street price **$106.50**

Silverstone has manufactured some of the world's highest quality and functional cases. The TJ01 is the entry-level midi-tower chassis, and brings some of the quality from the high-end series.

The fascia is made of aluminium, as is the door that closes over the external drive bays to provide a clean, straight-edged front to the case. This can be a nuisance as it easily flies open. Centre-left of the door is a blue strip of anodised aluminium that provides a striking contrast with the black of the rest of the case. To the lower right, on the side, are the front media ports, while the on/off switch, reset switch and activity LEDs are on the lower-left front, hidden behind the door.

Two 60mm intake fans and one 80mm exhaust fan round out the cooling, contributing to the noise generated from the enclosure. We'd prefer to see later interpretations incorporate larger fans.

Silverstone has chosen to include six external 5.25" bays, two external 3.5" bays and four internal 3.5" bays. Six 5.25" drive bays is a little overkill for the budget market.

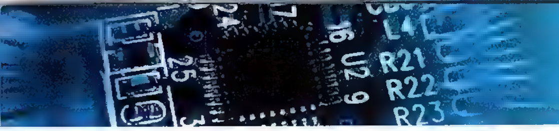
Similar in size to the Lian Li PC-7S, the TJ01 can hold a large-sized graphics card like the 8800 GTX but this will result in the loss of one of the HDD bay mounts, and more for dual-graphics.

Aesthetically, the Silverstone TJ01 offers an attractive aluminium fascia and equally sexy side panels with a mirror finish. The visuals are marred only by the fact that the TJ01's side panels aren't actually black in colour – more a gun-metal grey. This unusual combination mixed with anodised black aluminium can't help but look mismatched.

Although lighter then the NSK4400, the TJ01 is still hefty at 7.3kg. The construction of the enclosure is well done, with rolled edges to the steel assuring that our baby soft hands weren't aggravated when installing hardware.

Overall, the TJ01 is an economical offering from Silverstone, and another light within the budget case purchasing world. Lian Li is not the only manufacturer capable of constructing a high quality and sophisticated budget box.

SCORE 8.0 OUT OF 10



Antec SLK1650B

Specs **ATX and micro-ATX; 3x external 5.25" bays; 2x external 3.5" bays; 3x internal 3.5" bays with silicon mounts; 1x 80mm intake fan mount; 1x 120mm fan mount with an Antec TriCool 3-speed fan; 1x 80mm side panel fan mount; 2x USB 2.0; SECC steel; 9.0kg; 422 x 211 x 419mm.**
Supplier **Altech** Website **www.altech.com.au** RRP **$129** Street price **$94.70**

Antec's SLK series is well known as fully-featured and budget-oriented and the SLK1650B is no exception. In fact, it hasn't changed in years. For a little more cash, the same company can sell you a case with an updated fascia and increased PSU wattage.

The fascia of the SLK1650B shows the heritage of the SLK series. Fabricated completely from plastic, it shows the budget styling and orientation of this particular case. While average-looking, at least the power switch is of a decent standard and offers a smooth press and release.

For cooling, the SLK1650B is similar to the NSK4400 – a front 80mm intake fan, rear 120mm 3-speed TriCool fan and a side-mounted 80mm fan for focused cooling of the processor. A 120mm fan in the place of the 80mm fan used for the front intake would have made a good addition.

There are three external 5.25" bays, two external 3.5" bays and three internal 3.5" bays available to fulfil all your storage needs. Notably, the three internal 3.5" bays have silicon mounts. This is surely a positive for those looking to make not only a budget PC, but a quiet one as well.

The interior space is somewhat limited. If the SLK1650B was an extra 5-10mm longer it could house a large-sized graphics card such as the 8800 GTX. That said, if the case was extended, the length of a monstrous graphics card would still eliminate a HDD mount. As partial compensation, there's decent spacing between the internal 3.5" bays and the edge of the motherboard PCB.

Visually, the case is dated – boring and quite frankly an enclosure for the family PC. At a hefty 9kg, this enclosure isn't exactly the easiest to move around for LANs. The reason for the weight is the complete SECC steel construction, as well as the included PSU. The construction of the case is generally well done with rolled edges, however there are still some edges within the case that feel a little burred.

The SLK1650B was good in its day and still is a contender for the budget market. But, for a few more bucks better cases are on offer.

SCORE **5.5** OUT OF 10

Antec Minuet 300

Specs **Micro-ATX; 1x external 5.25" bay; 1x external 3.5" bay; 1x internal 3.5" bays with silicon mounts; 1x 80mm 3-speed side-mounted fan; 2x USB 2.0; 1x IEEE 1394; SECC steel; 6.4kg; 324 x 97 x 427mm.**
Supplier **Altech** Website **www.altech.com.au** RRP **$149** Street price **$112**

The Minuet 300 is undeniably small. The interior offers extremely limited space to work in – the case is only capable of housing micro-ATX form factor motherboards and half-height expansion cards.

The fascia appears to be a miniaturisation of the Antec Overture II case. It offers a very clean, non-reflective silver surface surrounded by a reflective, chrome-like bezel that frames the front. As the case is obviously designed for HTPC activities, we were rather perplexed as to why the front media ports were not covered, or placed on the side of the case.

The cooling provided is fairly simplified, with only a single 80mm fan mounted to the side of the case, a fan within the PSU and ventilation holes at the rear and above the CPU socket. The drive space available in this system is scarce at best, with one of each generally expected drive bay type included. Thankfully, the caddy that holds these bays can be easily removed from the rest of the enclosure, allowing easy access to the otherwise near-impossible to access internal 3.5" drive bay.

The Minuet 300 has a rather appealing look. The case incorporates multiple shades of silver on the fascia, contrasted with a highly reflective, piano-black set of side panels.

This case is obviously tailored towards the HTPC market and thus there are multiple restrictions on hardware use. It can't incorporate ATX motherboards, ATX specification power supplies, full-height expansion cards and multiple storage devices. Surprisingly, the Minuet 300 is quite heavy at more then two-thirds of the weight of the SLK1650B, despite being only one-third the size.

Conveniently incorporated is a 300W PSU, which offers a 24-pin ATX plug, a 4-pin connection, two standard 4-pin drive connections, one floppy connection and one SATA connection. The PSU is sufficient for this enclosure – if you were to integrate enough hardware to push the system over the 300W barrier, the Minuet 300 really wouldn't be the case for you.

It's a neat little package but lacks the versatility of the full ATX enclosures and even the AOpen G325 micro-ATX case in the roundup.

SCORE **6.0** OUT OF 10

AOpen G325

Specs **Micro-ATX compatible; 1x external 5.25" bay; 1x external 3.5" bay; 2x internal 3.5" bays; 2x USB 2.0; 1x IEEE1 394; SECC steel; 4.65kg; 280 x 260 x 405mm.**
Supplier **Bluechip**
Website **www.bluechipit.com.au**
RRP **$150** Street price **$134**

Poised to attack the small form factor and micro-ATX communities, AOpen's G325 has a fascia built of smooth, sleek lines and silver, red and black colouring. There's an optical drive and FDD stealth cover to provide a seamless front. Although the fascia is fabricated completely from plastic, it maintains rigidity and strength.

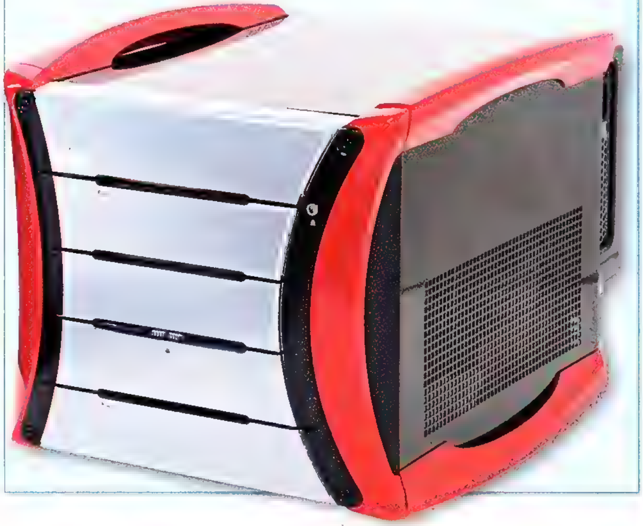
Not including any fans or fan mounts within the case design is a bold move! All cooling is provided by large ventilation on the side panel and an internal HSF setup, and emphasis is placed on the PSU's built-in fan. An overclocked chip combined with a high-power graphics card could stress the capabilities of this case.

The G325 has a single 5.25" drive bay, single 3.5" external drive bay and dual 3.5" internal drive bays. For a SFF system, this is the norm. The drive bays are well placed so that the CPU socket area is clear, so a large third-party HSF could be incorporated. No monstrous graphics cards – the 8800 GTX is just too big to fit.

The styling is very dominant and aggressive for the size. The complete steel construction is also quite heavy at 6.38kg.

The dated 400W power supply is a concern. It sports only a 20-pin ATX power connection, a P2 power connection and single SATA power connection. And the cables are not sleeved, twisted or managed at all.

SCORE 7.5 OUT OF 10



Conclusion

In the budget case sector, there really is a variety of options that not only offer different shapes and sizes, but also options of varying quality.

We found that Lian Li, with its PC-7S, drew heavily on its strong heritage of premium enclosures. Without doubt, the PC-7S was the best of the roundup. With great features, solid construction, light weight and the expected Lian Li style, it was a clear winner.

At the other end of the spectrum are cases such as the iCute GTR HQ01 and Antec SLK1650B. Both offer rich features, but sadly these are dulled by flaws that cannot be ignored. If you're looking for a high quality, well-designed and constructed case within the sub-$150 price bracket, you simply can't go past the Lian Li PC-7S.

No advantage is unfair

The best players rely on Sennheiser. Thanks to the ultra-comfortable headband, hour long game playing and internet surfing on your PC will become a totally new and exciting experience. Its noise cancelling microphone, inline volume-control and the microphone mute function is sure to give you an added advantage. Sounds tough for the competition, right?

For your nearest authorised dealer
Australia Free Call 1800 648 628 Email: sales@syntec.com.au
New Zealand Call 09 263 9885 Email: sales@syntec.co.nz

www.sennheisercommunications.com.au

Rock USB foot warmer

Price $30 **Supplier** Anywhere
Website www.anywhere.com.au

What wondrous things the human mind can devise, when motivated by cold feet! Potentially a top-shelf invention of all time, the Rock USB foot warmer teases then disappoints. USB's five volts isn't enough to juice up the heating pad in these things. Not by a long shot. The box claims a max temp of 45°C. Our feet disagree. Forgetting about the power, as fluffy polysomething slippers they are poor heat-traps. The Achilles heel though is that it's a one-piece unit. Like having your feet tied, stand up while you forget they're on and you'll fall flat on your cold face.

Bluegears b-cool temp display fan

Price $TBA **Supplier** iCompany Group
Website www.icompanygroup.com

Just when you thought there was nothing more fancy left to add to case fans, along comes this ace bit of show-off kit. LEDs along a spinner spell out the ambient temp and a useful rendition of the word 'Cool' in red or blue. The spinning creates the words from a mere handful of LEDs, writing them seemingly in thin air. The 80mm fan also shifts 23cfm, as if that matters when it's fabulousness that counts most here.

RoboQuad

Price $179 **Supplier** Wowee **Website** www.roboquadonline.com

Wowee make toy robots, of the relatively sophisticated yet surprisingly cheap variety. We think this will make the world a better place one day soon. RoboQuad is the best cheapy so far, it doesn't try to be a dinosaur, it's just a slickly-engineered plastic crab with the head of the Mars Rover. It waddles around in autonomous mode amusingly, occasionally getting stuck in corners. It does preset dances, and you can program tricky sequences. Most usefully, in sentry mode it will babble and squeal whenever evil parents try to invade number one son's bedroom.

Natural Point TrackIR 4 Pro

Price $260 **Supplier:** Natural Point
Website www.naturalpoint.com/trackir

This essential kit for sim gamers keeps getting better. The latest version offers a wider field of view – 46° – which in practice means you end up moving your head less for greater precision. It has a much faster sensor too, with a 120fps sample rate. Coupled with a doubling of the sensor resolution results in beautifully smooth head tracking. Flight sims, racing sims and now even FPS games are VR-enabled with the amazing TrackIR. Don't play without it!

Digital Audio Sender

Price $149.95
Supplier G.D.B. International
Website www.gdbint.com.au

The USB transmitter is recognised as a sound card, and it broadcasts your music to the small round receiver, into which you plug speakers or headphones. It's a neat and easy trick. Sound quality depends on range. We found that about 10 metres was acceptable before quality diminished, but it can throw to about 30 metres with lower quality. The 2.4GHz transmitter likes a clear line of sight, but can punch through thin doors or people. Using a cable instead is much cheaper, but this is sexier.

Cooler Master CoolViva Pro

Price TBC **Supplier** Cooler Master
Website www.coolermaster.com

If for whatever reason you're not satisfied with your existing graphics card cooler, here's an off-the-shelf part from Cooler Master. It has a copper base and three heatpipes and blows cool air over your memory, as well as around the general vicinity of the card. It supports NVIDIA 6200 and ATI X600 and higher, so if you're hankering for a gruntier cooling solution than the pissant cooler your card came with, and don't mind the fiddle involved with the swap, consider this one.

Welland GreenStar HDD enclosure

Price $59 **Supplier** Anywhere
Website www.anywhere.com.au

HDD enclosures are a dime a dozen, but unless you buy a proper integrated design from the likes of Seagate or Maxtor, all you get is a box for your standard drive. The GreenStar features all the goodies the top shelf solutions come with. Its 'Idle' mode extends the MTBF of your standard drive, plus a bottom end 'Suspend' mode spins the drive down completely for long periods of inactivity. It even has one-touch backup. Neat.

V-Gear MyVideo

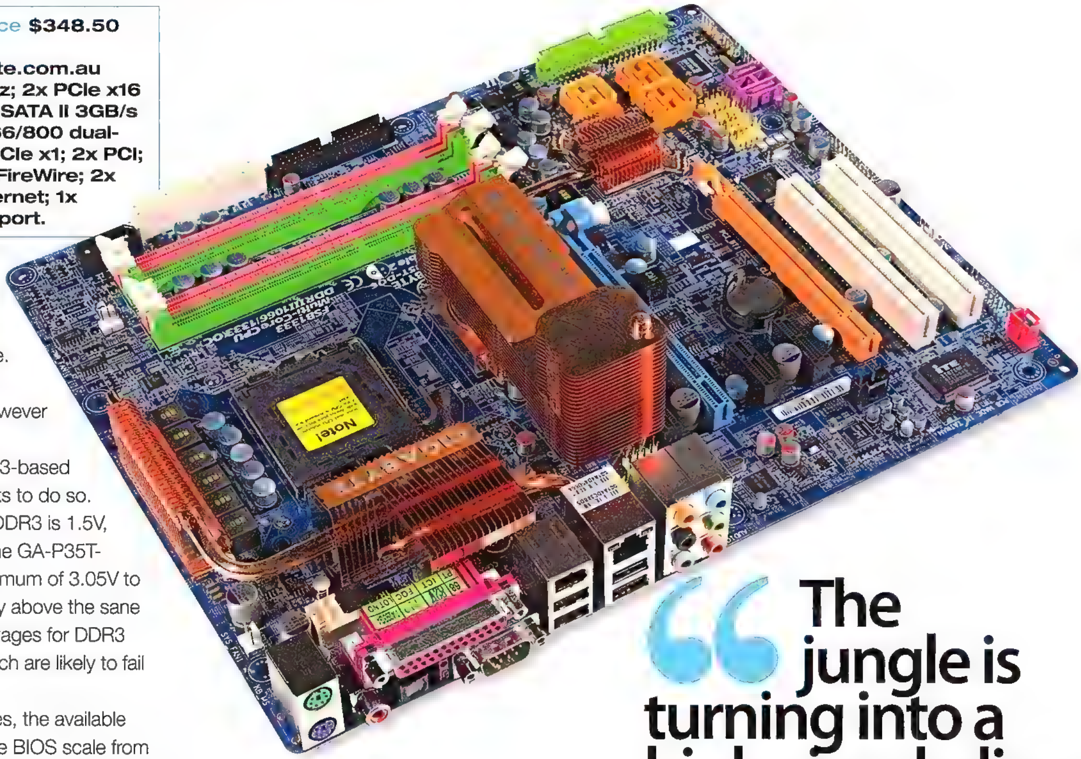
Price TBC **Supplier** V-Gear
Website www.vgear.com

If you're out of slots and simply cannot do without video capture hardware, then stick this in your USB port and smoke it. It does realtime MPEG-4/2/1 encoding, can capture from lovely old VHS, V8 and Hi8, and comes with its own video-editing software. Its coolest trick is burning captured video straight to CD, DVD or SVD without the files needing to go anywhere near your hard drive.

Gigabyte GA-P35T-DQ6

Josh Collins goes for a stroll with Gigabyte's latest DDR3-based baby.

SPECIFICATIONS
Price **$TBA** Street Price **$348.50**
Supplier **Gigabyte**
Website **www.gigabyte.com.au**
Specifications **1333MHz; 2x PCIe x16 slots (x16 and x4); 8x SATA II 3GB/s ports; DDR3 1333/1066/800 dual-channel support; 3x PCIe x1; 2x PCI; ATX; 12x USB 2.0; 3x FireWire; 2x S/PDIF; 1x gigabit Ethernet; 1x serial port; 1x parallel port.**



The GA-P35T-DQ6 is based on the Intel P35 northbridge chipset, paired with the new ICH9R southbridge. What makes the GA-P35T-DQ6 however different to the GA-P35-DQ6 however is support for DDR3 memory.

It can take up to 8GB of DDR3-based RAM and offers four DIMM banks to do so. The specified stock voltage for DDR3 is 1.5V, opposed to DDR2's 1.8V, and the GA-P35T-DQ6 allows for a ridiculous maximum of 3.05V to be set in the BIOS. Well and truly above the sane and even possible operating voltages for DDR3 memory modules – many of which are likely to fail above 2.0V.

On the topic of insane voltages, the available options for CPU VCore within the BIOS scale from 0.5V to 2.35V in steps of 0.00625. Considering the average Core 2 Duo operates at 1.325V and will either be melted silicon above 1.9V, with sub-zero cooling necessary, or generally fail to operate at speeds below 1.125V, the extreme range of voltages becomes rather laughable.

These voltages also bring to light another issue – they are accessible within the normal BIOS tweaking options, yet Gigabyte still insists on hiding memory timing and sub-timing controls behind the Ctrl+F1 barrier. At *Atomic*, we fail to see the logic behind this. A simple CMOS reset can save a system from a bad set of memory timings but a zap of over-spec voltages can royally screw your pride and joy so far into the ground, it will be saying hello to your great Auntie Dora.

These options aren't all doom and gloom however. Seeing as the board is a high-end offering and likely to be picked up by overclockers, this could offer a great basis to pair the insane voltage options with some equally insane cooling and performance. There are always two sides to these issues and ultimately if a manufacturer does offer these types of settings, they really need adequate warnings.

Thankfully Gigabyte does just this. With large red flashing text telling you when Gigabyte considers you've gone too far and generally these indications are on point. Therefore, only two kinds of people would knowingly push past them: High-level overclockers and little kids hell-bent on killing their machines.

We're not the greatest fans of the heatpipe jungles overtaking our motherboards. Unfortunately, the GA-P35T-DQ6 doesn't do anything to swing these feelings into the love sector. The jungle now seems to be turning into a high-rise filled skyline of copper towers with interconnecting heatpipe highways. This will cause many third-party heatsinks to likely have issues mounting correctly, or attached fans will have to either be placed on the side closest to the memory or near the top edge of the motherboard PCB.

As much of a nuisance as the configuration is, it does its job – not only well, but quietly too.

> "The jungle is turning into a high-rise skyline of copper towers with heatpipe highways."

The board is covered in solid-state capacitors, continuing Gigabyte's industry lead. This improves the system's ability to maintain solid power when under heavy loads.

In the performance stakes the GA-P35T-DQ6 had a strong showing. Scoring 11,167 in 3DMark06, 1min 38.938s in SuperPi 4M calculation, 29.25s in wPrime 32M calculation as well as 7477MB/s, 4879MB/s and 66.5ns in Everest's memory read, write and latency tests respectively.

The board is also a solid overclocker – the FSB hitting 505MHz. With further BIOS updates and tweaking, we're confident it could go higher still.

Overall, the GA-P35T-DQ6 offers a confident base to build on and a leap into the relatively unknown DDR3 world.

	Gigabyte GA-P35T-DQ6
Everest Memory Read (MB/s)	7477
Everest Memory Write (MB/s)	4879
Everest Memory Latency (ns)	66.5
wPrime 32M (s)	29.25
SuperPiMod 1.5	1m 38.938s
3DMark06 (3DMarks)	11,167

SCORE **8.0** OUT OF **10**

Thermaltake Toughpower 1200W

SPECS
Price **$TBC** Street Price **$445**
Supplier **Anyware**
Website **www.anyware.com.au**
Specifications **24-pin ATX; 4-pin P4; 8-pin EPS 12V; 3x 6-pin PCIe; 3x 8-pin PCIe; 4x 4-pin; 8x SATA; 2x floppy; silicon noise isolation mount.**

The Thermaltake Toughpower 1200W is designed for the pinnacle of the high-end enthusiast scene. Based on the CWT-constructed OEM power supply units, though without the Fuhjyyu capacitors, the 1200W, like its 1000W brother, has a respected performance heritage. Designed to feed power to dual-graphics, quad-core/multi-processor, multi-storage personal super computers, this monster demands respect… but does it deserve it?

We hooked the unit up to the Antec ATX PSU tester to see what the readings were. The LED readouts showed the 12V, 5V and 3.3V rails to all be healthy. We then tested each voltage reading with a digital multimeter and found the readouts to display 12.27V, 5.15V and 3.37V.

Not happy with the results as there was little load on the system, we then went to work to construct a system many would deem worthy of such a beast of a power supply. The system consisted of an ASUS L1N64-SLI WS motherboard, 4GB of DDR2-800 @ 5-5-5-15 2T, two AMD FX-74 Socket LGA-1207 processors, an NVIDIA 8800 GTX and Western Digital WD7500AAKS hard drive. Though nowhere near filling the amount of expansion ports and slots offered by the motherboard, this system was nonetheless going to offer some fairly serious strain to the power supply.

Running on our behemoth, the Toughpower 1200W held it's own on the 3.3V and 5.0V lines, pumping out 3.248V and 5.021V respectively, yet fell to its knees on the 12V line providing an underwhelming 11.369 volts.

The Thermaltake Toughpower 1200W is a modular, cable-sleeved, high-wattage, steady hitting super heavyweight, and congratulations to Thermaltake for hitting this amazing milestone. It was a pleasure to work with and ticks almost all the right boxes.

Unfortunately, the less then satisfactory results on the 12V output on our AMD 4x4 dual-FX processor behemoth left us pondering whether it is really ready to take on the heights of personal computing technology. **JC**

SCORE **7.0** OUT OF 10

Kingston HyperX PC3-11000

SPECS
Price **$TBC** Street Price **$TBC**
Supplier **Kingston**
Website **www.kingston.com**
Specifications **DDR3 1375; PC3-11000; 7-7-7-20; 1.7V; non-ECC.**

DDR3 has arrived, and while it's only just trickling in, it is definitely here to stay. The latest company to release sticks that accommodate this standard is Kingston, specifically its HyperX PC3-11000 modules.

Due to DDR3 being so new, we currently don't have a standardised system for testing such kits. So we replaced our standard EVGA 680i SLI motherboard with the Gigabyte GA-P35T-DQ6.

To obtain the stock frequency of DDR3 1375 we chose to overclock the FSB to 430MHz, set the X6800's multiplier to seven, manually set the timings to 7-7-7-20 and implemented a 5:8 memory divider. This resulted in the memory running at DDR3 1376 and the X6800 running an effective core frequency of 3010MHz.

At these speeds Everest's read, write and latency benchmarks scored 8806MB/s, 7828MB/s and 59.1ns respectively. In the Super Pi 4M calculation the system scored 1min 36.484s and 29.093s for the wPrime 32M calculation. These results demonstrate the massive bandwidth offered from DDR3 over DDR2, even after taking into consideration that the FSB is overclocked to reach the specified speeds.

Already extremely fast, we couldn't help but overclock the modules. After setting the FSB to 466MHz, lowering the multiplier to six, manually setting timings to 7-7-7-20 and enforcing the 5:8 divider we netted ourselves a healthy memory frequency of DDR3 1491, however with a lower CPU frequency of 2796MHz.

These new settings scored 9368MBs, 7413MB/s and 56.1ns in the Everest memory read, write and latency benchmarks respectively. Following on from here, we ran the Super Pi 4M calculation which returned a score of 1min 40.344s and wPrime 32M calculation which returned a 31.328s score. Here we can notice an increase in the bandwidth-related benchmarks and a decrease in the more CPU-intensive benchmarks due to the 214MHz slower CPU frequency.

The Kingston HyperX PC3-11000 memory kit shows a solid future for the performance of DDR3 and should leave any Atomican drooling at the mouth for more. **JC**

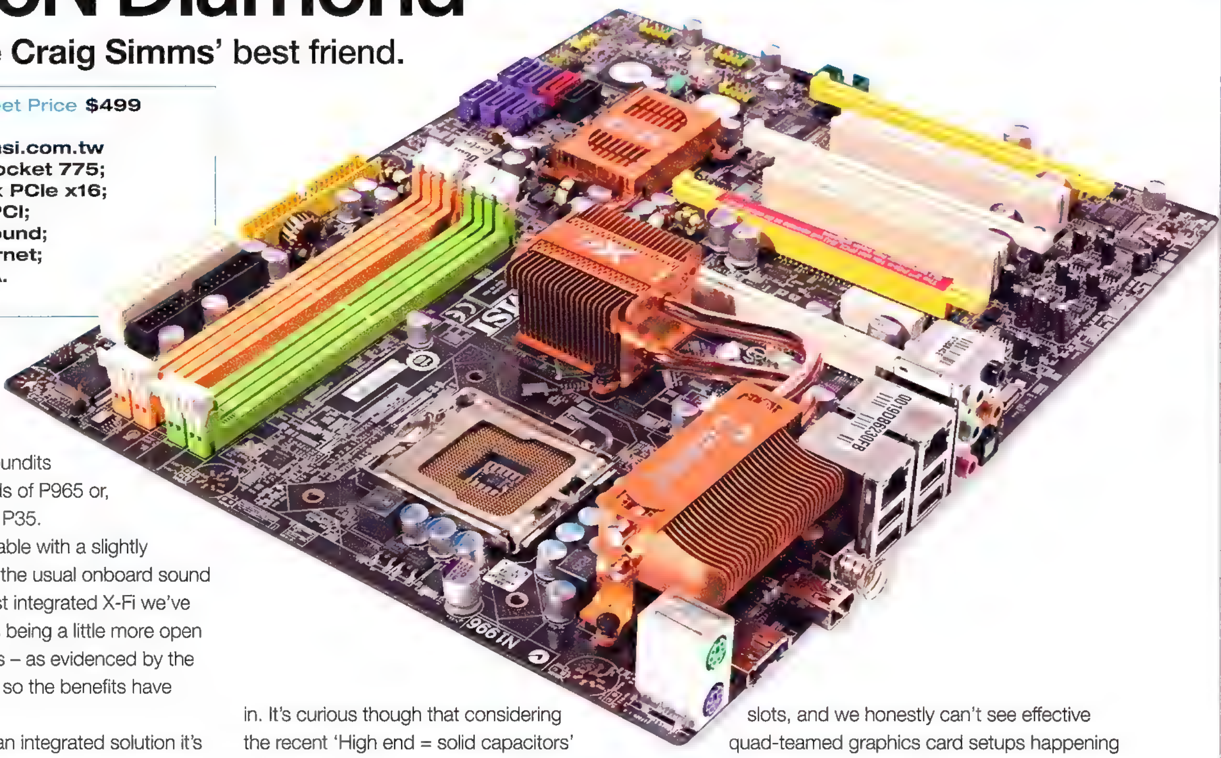
SCORE **8.5** OUT OF 10

MSI P6N Diamond

Diamonds are **Craig Simms**' best friend.

SPECIFICATIONS

Price **$499** Street Price **$499**
Supplier **MSI**
Website **www.msi.com.tw**
Specifications **Socket 775; nForce 680i; 4x PCIe x16; 1x PCIe x1; 2x PCI; Creative X-Fi sound; 2x gigabit Ethernet; eSATA; 7x SATA.**



The 680i race is a difficult one. It's a good chipset, but the board prices scare all but the most feverish of SLI pundits off to the happy fluffy lands of P965 or, as the case may be now, P35.

MSI has come to the table with a slightly different tack, eschewing the usual onboard sound fanfare in favour of the first integrated X-Fi we've seen. It seems Creative is being a little more open with its licence these days – as evidenced by the Auzentech Prelude – and so the benefits have filtered on down.

As you'd expect from an integrated solution it's not the king of the pile X-Fi card, but the slightly chopped down Xtreme Audio. This means a few things – chiefly, you can't use Alchemy under Vista to fix your EAX problems, as it uses a host-based DSP. Regardless, it still offers better quality audio than the typical onboard sound, especially with access to Creative's Crystalizer and CMSS3D. Getting more information on the chip was difficult, but running it through RightMark Audio Analyzer showed it to be more than the expected glorified Audigy. In fact there's a whole mass of caps and chips at the back of the board that seem roughly equivalent to the same components on the OEM X-Fi PCIe x1 Xtreme Audio – so big ticks to both Creative and MSI here for managing to cram it all in. It's curious though that considering the recent 'High end = solid capacitors' mentality that the capacitors dedicated to sound certainly aren't solid.

Chipset-wise things are kept pretty simple on the 680i – it hasn't started dropping legacy features like Intel's P35 and X38 series. A VIA VT6308P chip handles IEEE 1394; the Realtek RTL8211BL pulling gigabit Ethernet duties; a Silicon Image SiI3531 looks after an extra internal SATA port and eSATA port – a SiI4723 looking after RAID; the Fintek F71882FG looks after hardware monitoring; and of course the Creative CA0110-IBG is what brings sound.

The board features four PCIe x16 slots, but if all are populated three will operate at x8, and one at x16. You can still happily run SLI with dual x16 slots, and we honestly can't see effective quad-teamed graphics card setups happening any time soon. Still, there are some esoteric x4 add-in board devices out there, or if you need to power several monitors it's a useful addition. What it does mean is that you only get two PCI slots, and one PCIe x1.

Layout is by and large excellent except for MSI's long-running insistence on colouring the RAM slots incorrectly – confusing which slots are which for dual-channel – and the 8-pin +12V connector is placed within the socket area, near the bend of the heatpipe. This means it's bloody difficult to access if you use anything other than a stock Intel heatsink. These are minor niggles in an otherwise well thought-out board. The only other standout problem was a coil that put out a consistent, high-pitched whine near the RAM slots, but it's likely that this will be limited to our sample alone.

Otherwise it really is a standard 680i board, performing roughly how you'd expect. As usual it's the overclocking that separates the motherboards from the, er, men, and here MSI did reasonably well, hitting 475MHz stable before the board would no longer get into Windows. As usual, this will no doubt improve as the BIOS is updated. What won't improve sadly is the extraordinarily loud optional northbridge fan that comes highly recommended when overclocking.

The P6N Diamond is an excellent offering from MSI, only really hamstrung as usual by the 680i's price. A flawed diamond – but regardless, a diamond it still is.

RightMark Audio Analyzer 5.5	X-Fi	Onboard X-Fi Xtreme Audio
Frequency response (dB)	+0.02, -0.19	+010, -0.01
Noise level (dBA)	-93.2	-96
Dynamic range (dBA)	93	95.3
THD %	0.0016	0.0041
IMD+ noise %	0.0068	0.0090
Stereo crosstalk (dB)	-94.2	-97.2

	EVGA nForce 680i SLI	MSI P6N Diamond
Sandra Processor Arithmetic Dhrystone (MIPS)	27,100	27,096
Sandra Processor Arithmetic Whetstone (MFLOPS)	18,593	18,594
Sandra Memory Bandwidth INT (MB/s)	5571	5585
Sandra Memory Bandwidth FLOAT (MB/s)	5637	5624
3DMark06	5259	5258

SCORE **8.0** OUT OF 10

Hitachi Deskstar 7K1000

SPECS

Price **$599** Street Price **$TBC**
Supplier **Legend**
Website **www.legend.com.au**
Specifications **SATA 3Gb/s; 3.5"; 1TB; 7200rpm; five platters; perpendicular recording; 3-year return to base warranty.**

We've been waiting for this day, much like a kid waits for Christmas. Or Hanukkah, or whatever you may celebrate. Either way, we've really, really been anticipating the arrival of the terabyte drive.

It doesn't look like much to begin with. In fact it's contained within the same old 3.5" form factor that we've known for around two decades. Nonetheless it is still the first terabyte drive, so the award goes to Hitachi for crossing the line first. Much like AMD hitting 1GHz first, Hitachi will probably be long-remembered for this technical achievement.

Apart from the surprise that it's finally here, what's even more eyebrow-raising is the somewhat affordable price of $599, a figure that can only drop over time. It's also surprisingly quiet, and comes with the benefit that most large drives possess – it's bloody fast.

How fast? Well, for reference, our current king for sustained speed is the Western Digital Raptor, a 10,000rpm drive that under the HDTach 32MB test pulls an astounding 78.2MB/s. For burst speed it's the Seagate Barracuda 7200.10 750GB at a brain chafing 274.6MB/s.

The Hitachi manages 191.8MB/s for burst with Seagate leaving it in the dust in this respect, but for sustained it manages a pants-tent-popping 72.7MB/s, the closest a desktop drive has ever been to the holy Raptors, especially considering it's spinning 2800rpm less per minute. What surprised us was even at this speed, the hard drive was exceptionally quiet, to the level you expect in Samsung drives. Stellar.

So that's $290 more than your average Raptor, significantly quieter, at 5.5MB/s sustained less, for 850GB more storage. If the pure size and potential data loss doesn't disturb you, we can see this one turning up in a few performance systems.

We're quite sure the Seagate competitor will be along soon, and we welcome it for two reasons – one, to see how its performance will stack up, and two, to drive down the price of these monster drives. With disks this size, you almost don't need to think about RAID 5 anymore – two disks in RAID 1 will do just nicely.

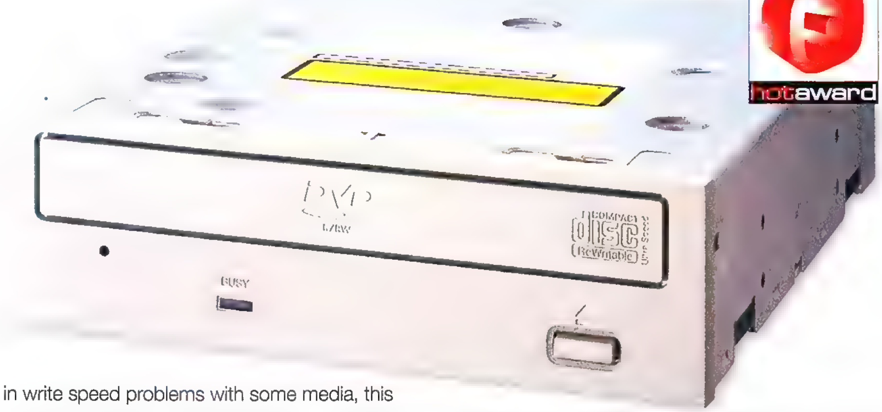
For now, Hitachi owns the crown. **CS**

SCORE **9.0** OUT OF 10

Pioneer DVR-212 DVD-RW

SPECS

Price **$89** Street Price **$50**
Supplier **Pioneer Australia**
Website **www.pioneer.com.au**
Specifications **18x DVD ±R; 8x DVD+RW; 6x DVD-RW; 10x DVD±R DL; 12x DVD-RAM; 32x CD-RW; 40x CD-R.**



As Pioneer's first entry into the SATA burner market, the DVR-212 has a lot to live up to. Competitors such as Lite-On, Plextor and Samsung already have SATA devices available, but the Pioneer stands apart as the first native SATA unit on the market – the rest use an EIDE bridge.

To begin, a fresh install of Windows Vista was done using the 212, dispelling the concerns that installing via SATA optical drive would be troublesome. Using IMGBurn and DVD Info Pro the drive was tested against media from Verbatim, TDK, Imation, and Taiyo Yuden. Verbatim 2.4x dual-layer discs happily spun at 8x and produced near-perfect parity and jitter results. These results were mirrored in all single-layer tests, even with particularly troublesome media. The 212 automatically over-speeds Verbatim 16x media to 18x, however TDK media failed to over-speed, with TDK003 only burning at 16x on the 1.15 firmware. As with many other drives in the DVR series, TYG02 8x still burns at 12x with no problems.

While immature firmware may currently result in write speed problems with some media, this will no doubt become the flagship burner of the Pioneer stable with little development required. Equipped with 10x burning support on double-layer media such as MKM003, the 212 is at the top of the game. Along with 12x DVD-RAM II support, the 212 is no slouch in dealing with exotic media types, however as with previous models, CDs burn at a maximum of 40x.

On lesser quality media such as Ritek F1 and CMC Mag M01, the DVR-212 comes out ahead of other burners in its class. While the 212 isn't the fastest on the market – Lite-On's 20x unit taking that crown – it certainly has the highest quality burns over all discs tested, with even the troublesome media from Moser Bayer coming out clear in the CRC tests.

Included with the OEM drive is a copy of Nero 7 Essentials, although there are more streamlined applications like IMGBurn available.

Our benchmarks show the 212 to be the best SATA burner around, and with a two-year warranty, you would be crazy to look at anything else. **IW**

SCORE **9.0** OUT OF 10

AOC 210V

SPECS
Price **$399** Street Price **$367**
Supplier **AOC**
Website **www.aocmonitor-anz.com**
Specifications **22"; 1680 x 1050; 5ms; 2000:1 dynamic contrast; 700:1 static contrast; 300cd/m^2; 170/160° viewing angle; VGA and DVI inputs.**

We've often been harsh on the 22" budget segment – particularly when there are monitors that don't deliver. Heave a sigh of relief then, because AOC's 210V is quite marvellous indeed, and we can be nice once more.

It employs Chimei's CMO M220Z1 L01 panel, so if you were allured by Chimei's price and screen quality but wanted a better chassis build quality, then the 210V will certainly pique your interest.

The stand is solid, and the screen small enough that all that's delivered in terms of adjustment is tilt – you can easily rotate by shifting the whole monitor. The not-so-great vertical viewing angle makes us wish we had height adjustment though, in order to minimise the effect of the darkening/lightening screen as your head moves.

The 2000:1 contrast ratio is 'dynamic' – which supposedly makes dark colours darker, and light lighter (much like Cold Power), but as with most dynamic colour systems, it tends to screw things up (much like Cold Power), and so we simply switched everything off – resulting in a 700:1 contrast ratio – and manually calibrated.

DisplayMate tests were passable, the monitor able to display the shades from 1 to 253 in the 255 greyscale tests, and colour gradients were excellent except for the green, which started to band noticeably towards the dark end of the scale. Movie watching and game playing was fine – we'd even go so far as to call this the perfect monitor for the gamer on a budget.

The OSD is annoyingly laggy and as a consequence is a pain to navigate, but it is heavily featured and should allow anyone but the craziest video nut to get a picture they're happy with. Fortunately most people will be able to set the features they want once and never touch it again.

Overall these are only small niggles, and for the price the AOC delivers in spades, and possibly buckets. If you don't want to spend nearly double the price for one of the amazing Dell, BenQ or Samsung 24" monitors, then this is your best bet. Recommended. **CS**

SCORE 8.0 OUT OF 10

Cooler Master Real Power M1000

SPECS
Price **$399** Street Price **$363**
Supplier **Cooler Master**
Website **www.coolermaster.com.tw**
Specifications **Modular; typical >85% efficiency; 1000W continuous output; 1200W maximum; 135mm fan.**

Cooler Master's power supply offerings have usually been solid efforts, but eclipsed by the likes of Enermax and Seasonic. Set to rectify this is its M1000 – a modular power supply throwing a full kilowatt of power down its lines to your system – providing it needs it in the first place.

The modular system is nicely thought out, with there being little chance of mistaking which ends should go where. Once again though, for a modular system, there's at least one excess cable involved – rather than offering an +12V connector that can be split from 8-pin to 4-pin, Cooler Master has supplied two separate cables, meaning at least one will be uselessly hanging all the time. The modular setup is still quite good though, with six possible connections allowed outside of the provided dual-PCIe 8-pin and 6-pin plugs – giving access to eight SATA plugs, one FDD plug and eight 4-pin power plugs.

It's at this point we'd like to address a misnomer that's ever-present across the industry, one that we have engaged in ourselves for the sake of a wider understanding – but no more! Four-pin power plugs have become commonly known as 'molex' connectors – however Molex is a brand that makes all sorts of connectors, not simply the 4-pin power we've come to know and love, making the name more than a little ambiguous. It just seems that, much like Vaseline and in the UK, Hoover, the brand name has blotted out the product name in the public's mind. Education – we've heard of it at *Atomic*.

Despite being shiny it's exceptionally difficult to place your fingerprints on the surface – a welcome addition. It's also wonderfully quiet and performs well, with the 3.3V, 5V and 12V rails giving 3.37V, 5.10V and 12.30V respectively at idle, while under load this slackened by 0.01V on all results.

Unfortunately it carries on Cooler Master's recent habit of not including a power switch on the back – something that we'd love to see returned as from a tweaker's or overclocker's perspective, it's invaluable.

Ultimately, the Cooler Master M1000 is an excellent power supply at a good price, with just a few small quirks holding it back from the top position. **CS**

SCORE 8.0 OUT OF 10

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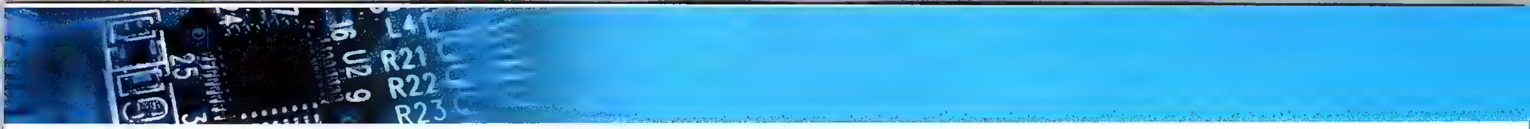


ATOMIC

Our choice for
the best gear the
land has to offer

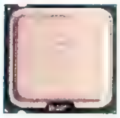
There's nothing sexier than new kit. And whether you need to horde your pennies (Budget), want the most power for your dollar (Performance) or own a small mansion and a collection of sports cars (Extreme), we're here to help with this handy matrix of *Atomic* recommended products. You may find your needs fall between categories – that's okay, just mix and match to suit your budget! Each piece of kit has been reviewed hands-on in *Atomic*, so if you want to learn more, look up the issue and page number listed.

CPUs | Motherboards | Memory | Video cards

BUDGET

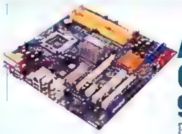
I can't afford to eat... gimme gear!

intel



Intel Core 2 Duo
PRICE $200-$480

Stretch a little further and buy yourself a Core 2 Duo – you'll be thanking yourself later. The E4400 is the cheap ticket to speed, at $185.



ASRock Conroe 945G-DVI
PRICE $113

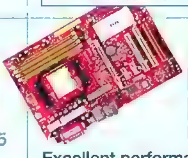
ASRock's budget board may be using old technology, but it runs the new stuff just fine, and can even overclock a little.

Reviewed in *Issue 70 – Page 60*

AMD

AMD Athlon 64 AM2 X2
PRICE $135-335

Cheap CPUs are a wonderful thing, and the X2s are now wonderfully cheap. The 3600+ is your budget baby at about $85.



MSI K9N Neo F
PRICE $113

Excellent performance from a budget board, with plenty of legacy slots for upgraders. Don't expect to overclock though.

Reviewed in *Issue 68 – Page 33*

Corsair Twin2X 1024MB 6400 Pro
PRICE $198

Corsair has a history of providing nice, stable and fiesty sticks of random access memory joy. These RAM sticks are EPP compliant, have low latency and are nicely overclockable. 800MHz of fun for everyone!

Reviewed in *Issue 69 – Page 51*

Powercolor X1950 Pro
PRICE $245

The X1950 Pro is nothing short of fantastic. Mind you, this could just as easily be the 7950GT, so watch this space in case the NVIDIA card drops in price.

Reviewed in *Issue 71 – Page 47*

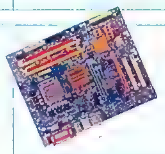
PERFORMANCE

Hardware that bangs the best for buck.

intel

Intel Core 2 Duo
PRICE $200-480

Core 2 Duo – crazily fast, crazily cool, crazily affordable, overclockable like buggery. The E6600 is the best buy, at about $300.



Gigabyte GA-965P-DS3P
PRICE $204

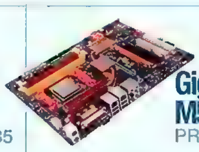
The 965P-DS3P is a ridiculous overclocker that can't be ignored. Buy a low-end Core 2 and go nuts!

Reviewed in *Issue 74 – Page 46*

AMD

AMD Athlon 64 AM2 X2
PRICE $135-335

The X2 series are still fantastic chips, and in the face of the Intel threat are now going for cheap. The 6000+ is your current sweet spot at about $235.



Gigabyte GA-M59SLI-S5
PRICE $250

Gigabyte delivers yet another affordable, feature-filled wonder of the 21st century.

Reviewed in *Issue 66 – Page 39*

Corsair Twin2X 2048MB 6400 Pro
PRICE $350

Yes, these are the same sticks recommended for the Budget system. Sadly, they are also the only RAM sticks we've tested that are compatible with AM2 and Conroe. So until we get more in, the Corsairs will stay.

Reviewed in *Issue 69 – Page 51*

GeForce 8800GTS 320MB
PRICE $410

DirectX 10 for the mainstream. 320MB is as good as 640MB in most situations – opt for the 640MB if you're going to play above 1600x1200.

Reviewed in *Issue 76 – Page 58*

EXTREME

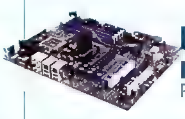
Gimme power. Money is no object.

intel

Intel Core 2 Quad QX6800
PRICE $1865

Now on par with the fastest dual-core, Intel's top of the line quad-core part is feisty and powerful.

Reviewed in *Issue 78 – Page 59*



EVGA nForce 680i
PRICE $435

Stupidly over-featured and fast, if you've got the cash, then plonk it down here.

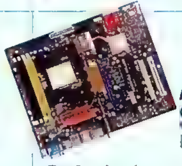
Reviewed in *Issue 72 – Page 47*

AMD

AMD Athlon 64 FX-62
PRICE $1072

Sadly gets beaten by a mid range Core 2 Duo, but still the top of AMD's pile.

Reviewed in *Issue 66 – Page 39*



ASUS M2N32 SLI Deluxe
PRICE $290

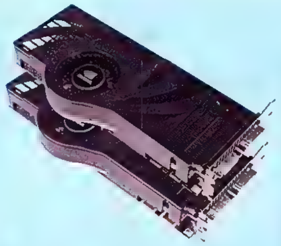
Perfection in a motherboard. Beautifully laid out and overclockable to boot.

Reviewed in *Issue 68 – Page 35*

Corsair Dominator Twin2X 10,000
PRICE $1016

Crazy speed sticks that will also happily do 1T/800MHz/3-3-3-3. Comes with a fan attachment to keep things cool!

Reviewed in *Issue 77 – Page 58*



XFX GeForce 8800GTX Ultra XXX Edition SLI
PRICE $1459x2

This is far and away the most powerful graphics card on the market, but be willing to sacrifice your entire retirement fund for the privilege of having one of these tearing up your screen.

Reviewed in *Issue 78 – Page 59*

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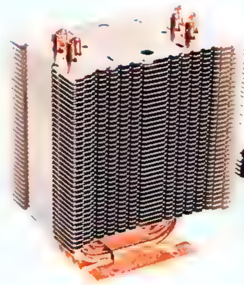
Coolers



Noctua NH-U9F
PRICE $80

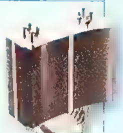
It may only be 90mm, but its cooling power is exemplary, coming in only slightly behind its 120mm brother.

Reviewed in *Issue 72 – Page 42*

Thermalright Ultra 120
PRICE $75

Tower cooling that will keep your tower cool. Whack a Nexus 120mm fan on for near silent cooling.

Reviewed in *Issue 72 – Page 42*



Thermalright Ultra 120
PRICE $85

Make sure you get the optional AM2 bracket (hence the higher price). Grab that same Nexus fan.

Reviewed in *Issue 72 – Page 42*

Asetek Vapochill Lightspeed
PRICE $1020

Vapour phase change. Ooooh. Vapour. Phase. Change. No matter how many times you say it, it's still cool (pun!)

Reviewed in *Issue 64 – Page 38*

Cool-Trek Vostok
PRICE $199

Until more extreme cooling systems come along that are AM2 compatible, this little kit will have to fill the gap. Make sure you get the updated mounting kit.

Reviewed in *Issue 68 – Page 41*

System drives

Samsung HD160JJ 160GB
PRICE $80

Super quiet and yet still fast, the 160GB Samsung offers excellent value for money.

Reviewed in *Issue 69 – Page 40*

Seagate Barracuda 7200.10 320GB
PRICE $130

Seagate's fancy new technology makes this beast both fat and fast. Mmm, toasty.

Reviewed in *Issue 69 – Page 40*

Western Digital Raptor WD1500ADFD
PRICE $330x2

Dear lord. The performance king hath cometh, short of whacking in a SCSI. Buy two and RAID 'em.

Reviewed in *Issue 62 – Page 40*

Displays

Samsung 931C
PRICE $405

2ms of raging colour gamuts and beautifully smooth tonality that will make you weep with joy and hug strangers.

Reviewed in *Issue 70 – Page 56*

Samsung 244T
PRICE $1477

Brilliance at 24", the 244T offers 6ms gaming, a wonderful gamut and more inputs than an alien hooker.

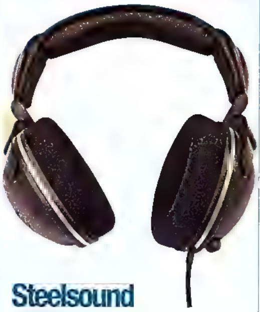
Reviewed in *Issue 69 – Page 48*

Hewlett Packard LP3065
PRICE $2718

Thirty inches, 2560 x 1600, 8ms G2G. If you can handle the size and cost to run this massive beauty, you won't be disappointed.

Reviewed in *Issue 76 – Page 53*

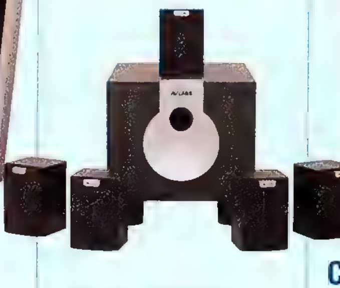
Speakers



Steelsound 5Hv2
PRICE $120

Awesome gaming audio performance on a shoestring budget. Phenomenal 'phones.

Reviewed in *Issue 73 – Page 43*



AVLabs AVL325
PRICE $165

While it can't hold a candle to the Z-5500D, with a price this low there's no excuse not to jump to 5.1.

Reviewed in *Issue 64 – Page 50*

Logitech Z-5500D
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Able to play the 'liquid gold' that is DTS 96KHz/24-bit, this 5.1 beast can wreck both home and hearing alike with equal impunity.

Reviewed in *Issue 48 – Page 56*

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Like the Stacker before it, this sensational Stacker stacks sumptuous specifications salaciously.

Reviewed in *Issue 61 – Page 36*

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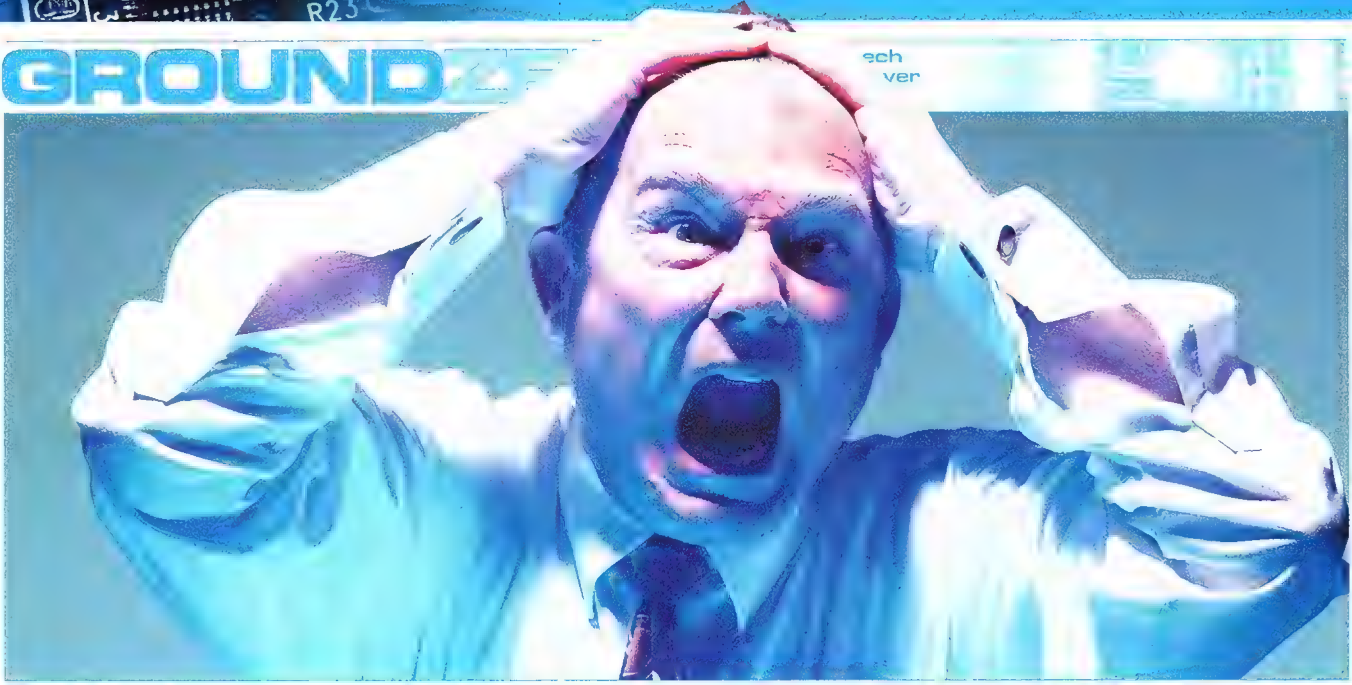

Save me!

Dan Rutter is just waiting patiently for his saved game to load.

You buy a new game. It pretty much works, but saving takes a while, and the save files are *300MB*.

W, you may be wondering, TF?

Like pretty much everything else in programming, saving games is trickier than it looks. But all the save function has to do is, well, function, to pass muster with the average game reviewer. So saving is not high on the list of priorities of the slave-drivers in charge of most games. So a lot of games have half-baked saving.

For some games, saving is easy. A good old-fashioned adventure game, for example, may be able to save the entire game state in a handful of bytes – where you are, what you're carrying, status of anything you've changed in the game – done.

Turn-based games of all kinds also have a beautifully quantified game world. Even if there are zillions of entities in your giant game of Civilization VIII, they each have a definite state that can be summed up in very little data, and saving and restoring should be simple.

If you're old enough to remember games that gave you a cryptic code every time you passed a level, be advised that sometimes that string of letters actually encoded the game state. The save game was short enough that you could just *jot it down*.

> “Games have grown… and there are now some frightfully clever ways to save a game.”

Things are different, though, in our brave new world of huge 3D FPS and RTS games. As games have grown, save schemes have had to develop too. There are now some frightfully clever ways to save a game.

If the game you're playing doesn't use one of them, though, here's what it may be doing.

Probably the simplest way to save a game is to grab all of the memory that the game engine's looking at and dump it to a file.

The problem with this is that, by definition, it makes a save file as big as all of the memory the game's using. For modern PC games, that can be many hundreds of megabytes.

That data is probably quite compressible. But compressing 100MB of save is likely to take at least a minute on a cutting-edge PC, or several minutes on Joe Average's old Dell. So big airy save files it is. And before you know it, the game directory's 12GB.

By the way, if you're wondering why even a FPS game can't just take a snapshot of every object in the world and save that, Civilization-style, I suggest you take a photograph of a person juggling and then attempt to use it to teach another person how to juggle.

'Journaling' is another simple way to save, and it gets around the vast-files problem. It involves recording all the user input, and making that the save file. When you load the game, it starts from the most recent game-state-snapshot point, like the start of a level, and then silently plays back all of your input until it gets to the place where you saved.

Journaling gives quite a small save file, and very fast saves. But *loading* the game can take forever. If a save that's 10 seconds into a new level loads much faster than one 10 minutes in, you're probably looking at journaling.

Journaling is also the standard technology for game recordings. You usually can't rewind a recorded game, because most realtime game engines can't run backwards.

Why do patches usually not improve saving? Because to add intelligent saving you have to grovel over the game's code, giving everything that needs saving the ability to export its status and import it again later. That can take a lot longer than writing proper save code in the first place, and it's not worth it for a 'finished' game.

But this is still kid's stuff.

If you *really* want to make a game developer crazy, ask him about *multiplayer* saves.

Email Dan to find out how he managed to save his shirt from the Seventies.
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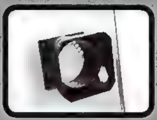
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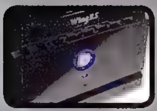
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GAMEPLAY

GAMES, GAMING AND GAMERS COVERED ATOMIC-STYLE

Kiwi sheep horror, underwater horror and dark, shadowy horror? This issue couldn't be more scary if we tried. And we do, honestly, try to top the frightfulness of our previous work. It's hard, damn hard.

Take for example, the excellent topping that is BioShock. With the game close to release, we arranged a candid interview with Irrational's Jon Chey to ask him the tough questions. The answers, from page 66 on, are very interesting. Kate had to battle her hardcore demons this month, and we're not sure if she beat them or not. She does own a pair of cats though. Oh, and to keep you on the very edge of your seat, we have The Darkness, all reviewed and shiny, awaiting your arrival on page 76. Action galore.

GAMEPLAY CONTENTS

Engine Room: BioShock 66

Our final take on the game that will make the great System Shock look like the Ping Pong of role-playing games. God willing, expect a review next issue!

Geekette 82

Kate Inabinet wants a casual relationship with her hardcore hubby. Or is that the other way around?

Game reviews

Transformers 74
The Darkness 76
Overlord 78

Culture Shock reviews

Black Sheep 80
Rant 81
Deadwood: Season 3 81
Jin-Roh: The Wolf Brigade 81

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SHOCK TREATMENT

Logan Booker harasses Irrational's Jon Chey about the intricacies of the scary FPS BioShock.

Above Throwing a spanner in the works/
Below You'll meet some interesting inhabitants.

Last time we questioned Irrational on the topic of BioShock (*Issue 65, page 54*), we took a close look at the story, themes and gameplay. With development drawing to a close, we decided to approach the studio again to tie up a few loose ends and get the final word on what BioShock means to Irrational and what it believes the game will do for you and I.

Irrational's director of product development, Jon Chey, was kind enough to lend *Atomic* his brain for the obligatory information-prodding.

Famous by association

BioShock has been branded as the 'spiritual successor' to System Shock, an FPS developed by Looking Glass Studios back in 1994, and tangentially its sequel, released in 1999 and co-created by Irrational. It is a given that, if EA did not own the rights to System Shock, that we would, right now, be discussing the third instalment in the series.

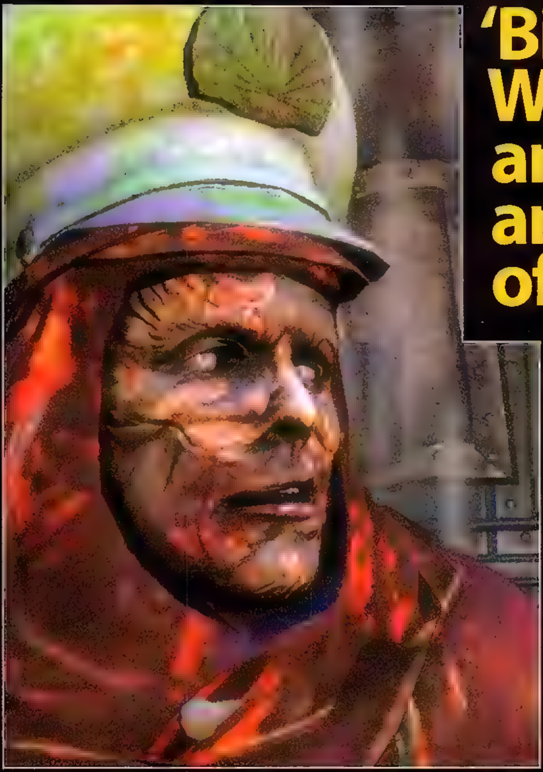
But we're not.

With this in mind, shouldn't Irrational be worried that BioShock is being associated with another game, and not recognised as an original IP and appreciated on its own merits? Along with the rest of the gaming community, we've just assumed the link to be a good thing.

'We're not concerned,' explains Chey. 'It's a useful way for people who know Shock to think about the project and I think we're still trying to achieve the same sort of goals with BioShock that we did with Shock 2.'

According to Chey, these goals include providing the player with a range of tools to interact with the game; immersing the player in the game world; allowing them to manipulate the environment; tinker with the AI and create their own weapons.

'But no one here is interested in making the same game again. We're trying to do that stuff in a pretty different way this



> **'BioShock's not an RPG. We're an FPS. But there isn't another shooter that has anywhere near the range of player tools that we do.'**

time around. Hopefully people will see that when they play the game. And I think a lot of those people will never have heard of System Shock,' says Chey.

This degree of interaction has often been touted by Irrational as an example of 'Emergent gameplay'. What the hell does that mean, you may ask? In the same way a game such as SimCity provides the tools to construct a metropolis, BioShock will deliver to the player the devices they need to escape the fictional underwater dystopia of Rapture. You just won't be told the best way to use those tools – if indeed you should use them at all.

The freeform nature of the game, especially the way in which it demands you play it your way, would naturally bundle the game into the role-playing genre. Chey, however, is quick to differentiate.

'We're not an RPG. We're an FPS,' he states. 'And that said there isn't another shooter that has anywhere near the range of player tools that we do. We have a huge range of tools, a big set of problems and we let you figure out how you want to apply one to the other. That's pretty unique for a shooter.'

Not the clearest description one could provide for a game, especially to the less seasoned gamer. Chey agrees that BioShock does take a few risks – much in the same way as System Shock did. Nonetheless, both his fears and confidence are rationalised.

'It's challenging, because whenever you break new ground in gameplay, there's always the danger of the "Huh?" factor. Will people get it when we don't tell them exactly where to go or how to solve a problem? I hope so, because when you do get it, you realise that kind of gameplay is so much more satisfying and rewarding.'

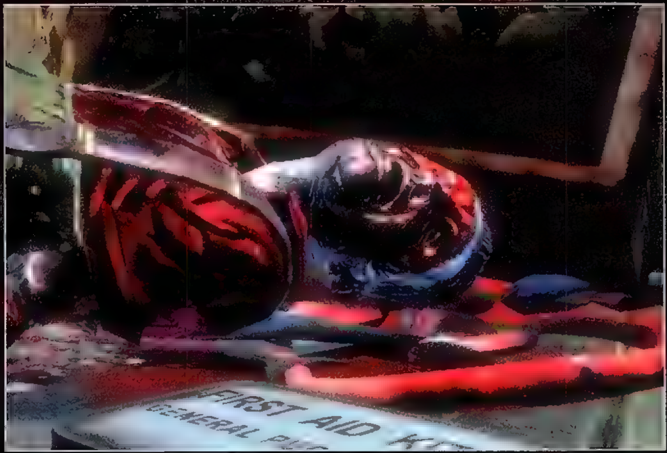
Into the depths

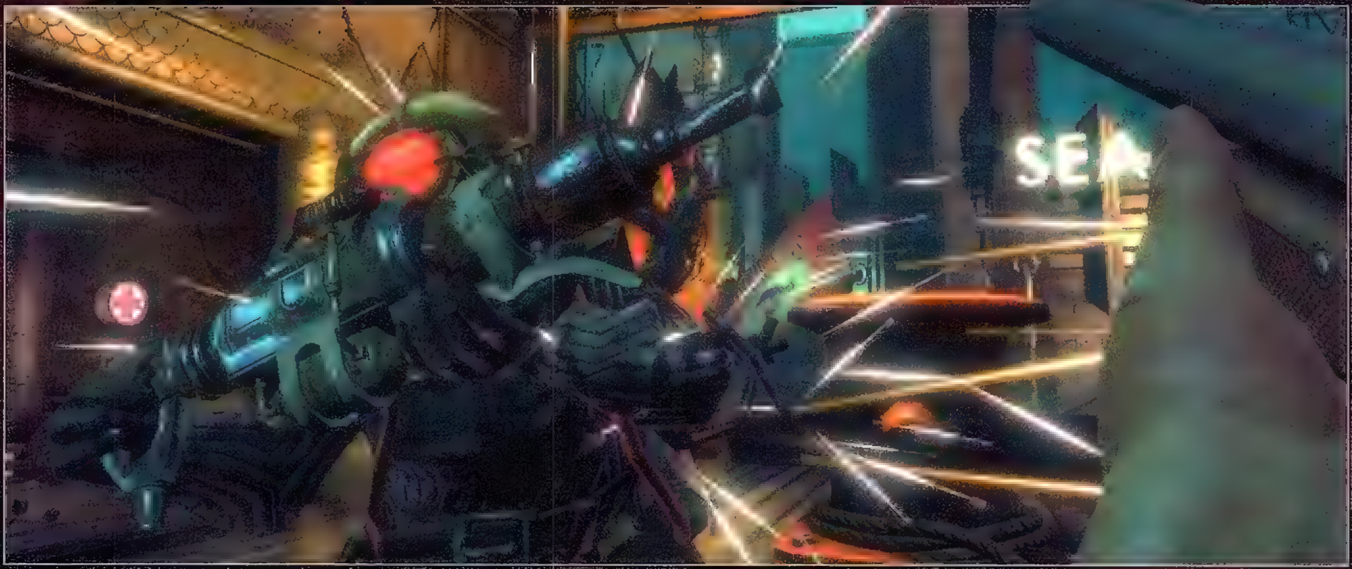
Wisely, Irrational does not assume that the player knows anything about the world they're about to enter, so the mysteries of Rapture are more than prepared to reveal themselves in their entirety over the course of the game.

If you're just interested in shooting everything that draws breath – be it through nose or gill – you can do that as well.

A run-and-gun approach will leave the player oblivious to the true beauty that lies within the hellish

Left Forget Oil of Ulan – you now have 'Adam'.
Below Welcome to Rapture: A city in a state of disrepair.





Above Quick! Before he manages to point that bloody thing at you.
Below 'Who's a pretty boy?'
Below right Fighting over fish food.

confines of the submerged city – for example, the intricately-weaved relationship between the game's Protectors and Gatherers. If you weren't already aware, it is from these two characters the player can harvest the most bountiful supplies of Adam, the critical ingredient in cooking with the gene mutation mechanic of the game.

However Protectors and Gatherers – also known as Big Daddies and Little Sisters – will not willingly part with such a precious commodity, and they are designed to work together to prevent such an event.

'Our biggest AI focus in this game has been developing the idea of a relationship between two AIs that isn't necessarily anything to do with you,' explains Chey. 'Of course, you can intrude on that relationship and, in fact, how you choose to do so will have a huge impact on what happens to you and the other residents of Rapture. For example, later in the game, you can develop tools with which you manipulate the Big Daddy – diverting his emotional attachment to the Little Sister for your own advantage.'

So say you do, using whatever process you choose – be it violent, subversive or surreptitious – steal the sweet DNA-altering nectar that is Adam and employ it for your own busy work? We know that players will be able to grant themselves unique powers using Adam and 'Plasmids', at the cost of their humanity. With such potent, tantalising abilities waiting to be taken advantage of, what's to stop you from just manipulating the crap out of your genome? Jon Chey comes to the rescue.

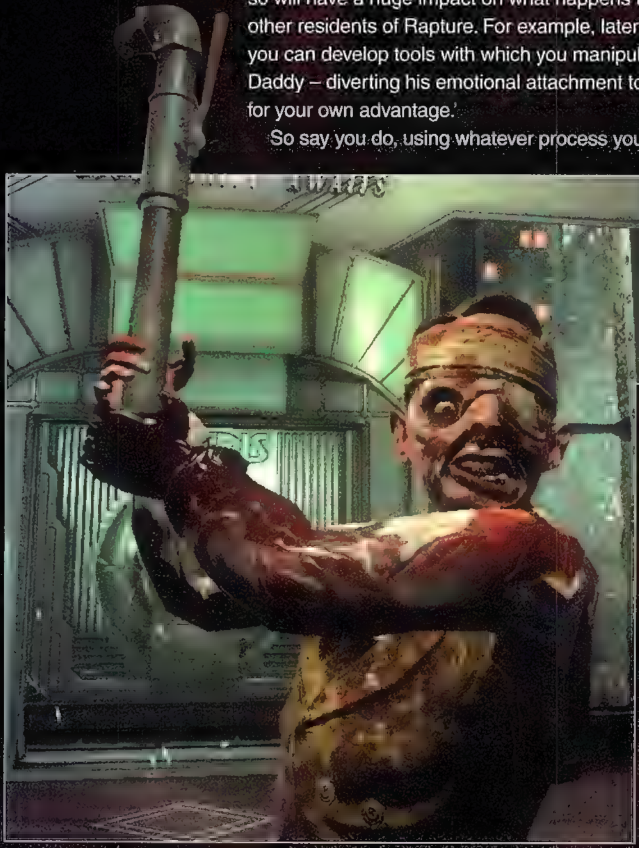
'BioShock is all about asking the question: How far are you prepared to go in order to get personal power and growth? Genetic enhancement is something that's going to be hard – but not impossible – to avoid in the game. What the *cost* of that enhancement is to you and to the other residents of Rapture is something that is under your control though.'

Chey's explanation suggests that without a few nips and tucks of your proteins, you're going to find Rapture a tough place to survive. Does that mean the powers birthed by genetic mutation are extremely potent? How does Irrational see the interaction between conventional methods of destruction measuring up against the paranormal?

'There's a very careful balance in the game between the powers of the Plasmids – powers gained through genetic modification – and conventional weaponry. In general, the Plasmids are about subversion and manipulation and weapons are about blowing stuff up. Maximising the potential of both is the key to success.'

So exactly how useful are Plasmids?

'Let's just say that the ability to breed and release a swarm of bees from your arm is pretty damn useful when



you're trying to survive in a ruined underwater dystopia,' says Chey.

If you're the traditional FPS type, and the frightening image of disgorging stinging yellow-and-black death from your body fails to impress you, Chey assures us that there will be plenty for you to rely on. For example, BioShock will handily provide you with everything you need to make your own weapons, from handguns and rifles to the more exotic.

'There are different upgrades that can be applied to each different weapon, so there are choices there about which weapon you want to upgrade and then which upgrade path you are going to go down with that weapon,' explains Chey.

Don't think all your run-and-gun questions have been answered though. Guns need to fire something, too.

'Beyond that, there are multiple different ammo types for each weapon, some of which can be found lying around in the world, but others of which have to be "invented" by putting together other components. So it's a pretty deep system.'

Of course, normal ammunition types will be littered about the confines of Rapture.

Well, maybe not littered, exactly.

'No one has enough of *anything* in Rapture. I mean, stuff is kind of hard to come by on the bottom of the ocean – other than fish. You're going to be *hungry* when you are playing this game…'

Thanks Jon. Now we really are shit-scared.

Polygonal water?

BioShock, apart from Unreal Tournament 3 itself, was the first game we became aware of that would be using Unreal Engine 3. Irrational has a solid working history with Epic's game middleware that includes Tribes: Vengeance and SWAT 4.

The developer hasn't abandoned the bits and pieces it put together for these titles, as Chey explains.

'The engine is a mix of tech from Unreal [Engine] 3, things we've worked on in the past and new tech we've developed entirely for BioShock. It's been crafted very specifically for the stuff we wanted for BioShock like detailed sound propagation, water rendering and physics and so on.'

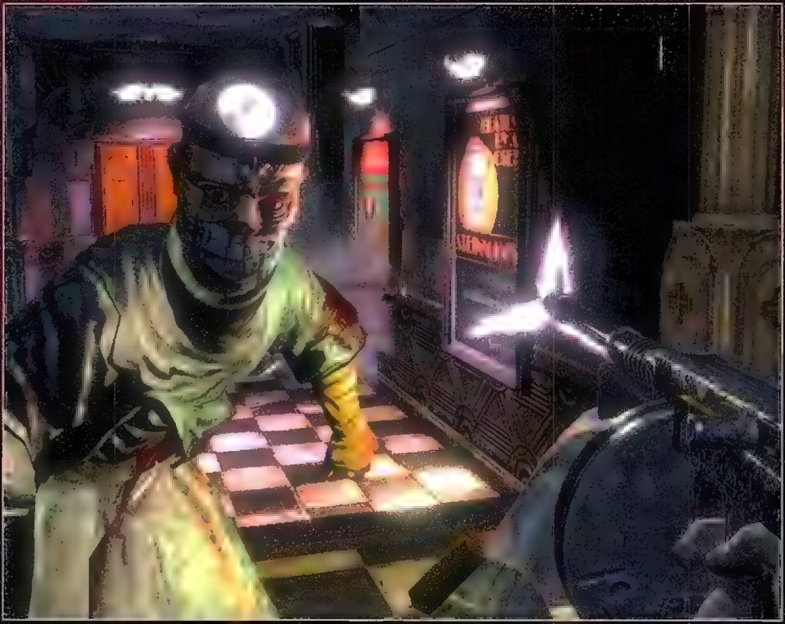
We talked of spiritual successors earlier – Irrational may as well be considered the successor to Looking Glass, considering those in the company's employment as well as the projects it has embarked on. Looking Glass was notable, however, for designing its own technology – the Dark Engine for instance, which powered Thief. Apart from the obvious production advantages, why did Irrational continue to pursue an external technology to produce BioShock – and for that matter, SWAT 4 and Vengeance?

'We're big believers in middleware,' states Chey. 'We like to get a flying start so that we can focus our technology efforts on stuff that is relevant to our game and distinctive. In that sense, nothing's really changed since Shock 2 in our approach. Of course, Unreal 3 is a few steps ahead from the old Dark Engine that powered Thief and Shock 2!'

We're not going to argue with that. What we will tackle though is the promise of realistic water from when we did our first look last year. The demo we saw back then didn't show anything particularly noteworthy in regards to fluid dynamics, but Chey says that with the game close to completion, Irrational has delivered on its statements of the moist persuasion.

'I think we've done some pretty incredible stuff with water. If you don't believe me, check our some of the videos we've released. When we show people the game in person we pretty much always hear that it's the best looking water they've ever seen in a game. Which is good for

Above The dating scene in Rapture is pretty rough. **Below** Shoot first, figure out what it was later.



Top Turning out the lights. **Right** The fashion police patrol Rapture. **Below** Fightin' in the foyer.

a game set in an underwater city, that isn't a text adventure.'

Chey also says that BioShock will be more than willing to abuse CPUs with multiple cores, given the opportunity. No doubt, this is thanks to the chunks of Unreal Engine 3 running under the bonnet.

'The engine is heavily optimised to make use of multi-threading on multi-core machines and we see a significant speedup on even dual-core systems,' he says. 'We run gameplay and AI on a dedicated thread and then can spread physics, rendering, audio and UI onto their own threads. Some systems such as physics and audio can be further broken down internally to span multiple threads, in order to make maximum use of all available core time.'

With the nine-cored PlayStation 3 and the three-cored Xbox 360, making sure a game is multi-core aware is quickly becoming a priority with game developers and Irrational is no exception. It's even more important in relation to BioShock as the game will not only debut on the PC, but Microsoft's next-generation console as well. The land of lounge gaming has long represented an unknown, yet fertile, world for Irrational, and BioShock looks like it will comfortably set up a base camp for further intrusions by the developer.

'We've been amazed at how great the 360 is as a development platform,' states Chey. 'You know, we've mostly been a PC developer in the past and that's where our roots are. But getting onto the 360 has been much more straightforward than we imagined. From the tech point of view, there hasn't been as much of a challenge maintaining both platforms as I thought there would be.'

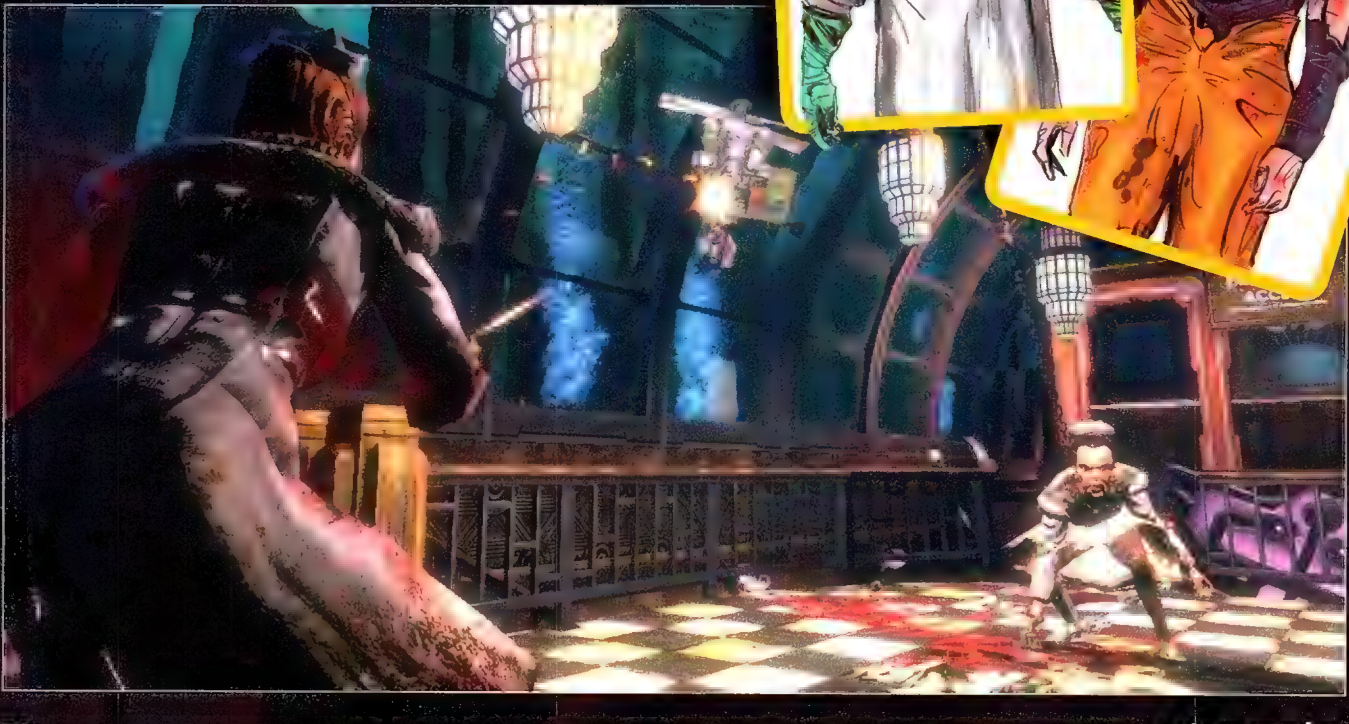
On the gameplay side, Chey says there are quite a few differences – or difficulties, depending on who you ask.

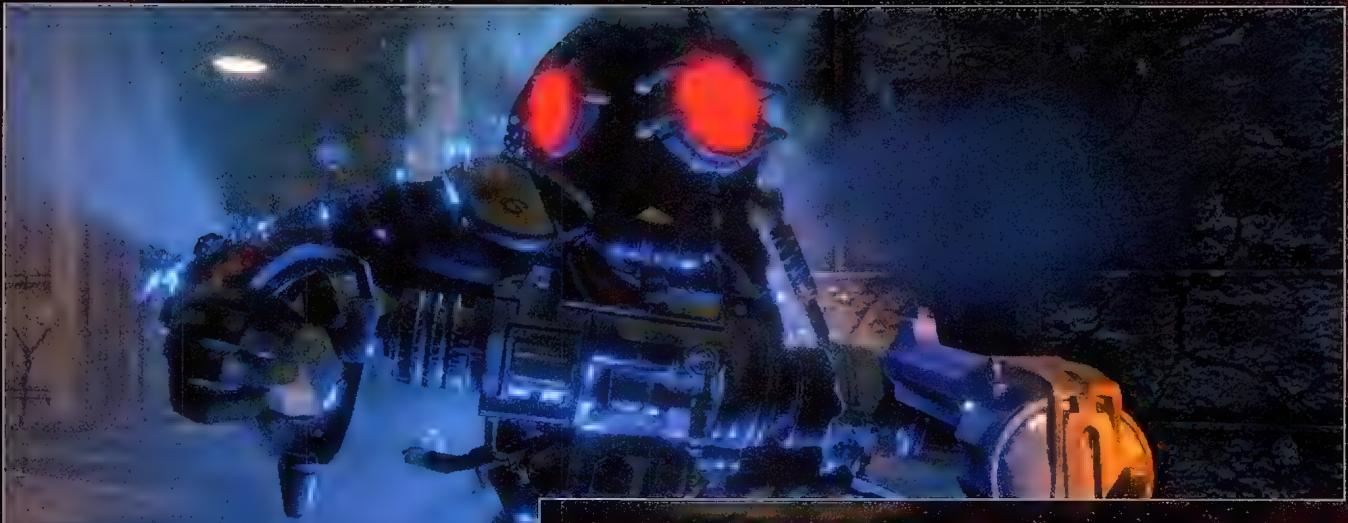
'Mouse and keyboard are still a more efficient tool for aiming and shooting than console controllers, and that means the challenges have to be pumped up for the PC version,' he says.

'And then there are other interfaces that are better navigated using the PC interface, like the hacking game where having a pointer just means you can operate more efficiently.'

Irrational has combated these problems with an elegant and straightforward solution: Using two teams to develop the game for each platform.

'At the end of the day, you have to ship two games and





Top Gunfighting on the ocean floor.
Above 'Take that bitch'.
Below The social security safety net ain't working.

we're well aware that, though they might share the same story and themes, they have to be tuned and balanced separately.'

Even with the dual-team strategy, Chey assures us that neither platform is considered 'lead' and that both are kept up-to-date with the latest asset and code builds. Technically, however, the PC offers the potential for more detailed particle systems and higher textures.

BioShock also presents another opportunity for Irrational – cross-development using Microsoft's XNA Studio. While Chey says that the developer has taken to the system, things didn't begin that way.

'When we started development on BioShock, XNA was only just beginning to take shape. So we only really use XNA in the form of sharing low-level libraries [DirectX, etc] across the PC and console code.

'This however has increased the quality of the game as a whole, because we no longer have to spend much time porting and rewriting code to run on both platforms.'

Stay awhile, stay forever

With many of our lingering questions answered, we were left with just one quandary: How long will this apparent blockbuster, descendent from the best genre games to ever grace the world, keep us occupied?

For the less poetic, how many hours will it keep you glued to your screen?

'Wow, that's always such a hard question to answer,' admits Chey. 'In a non-linear game like BioShock there is just a huge range of possible playtimes from the guy who just focuses on the core quest and never steps off the critical path to the guy who wanders around trying to collect every Plasmid in the game and find every secret.'

Chey uses Bethesda's Oblivion as an example of another game of questionable length – depending on how many side quests you complete in the Maryland, US-based developer's sprawling RPG, you could be there forever, or longer, leaving one's dietary and hygiene-related concerns to the fickle hands of fate and airborne bacteria.

In specific terms, Chey declares BioShock a shooter, first and foremost, and combat is what you'll spend most of your time doing. Of course, no game related to System Shock would be complete without an exploration element, and like Oblivion, you can waste as many hours as you want exposing the secrets of every room that game has stored in its data files.

'Plot development also has a core and an optional component. If you want to explore the back story and the world, go wander around, find secret logs and listen to them and so on, you can spend a long time doing that. But you don't have to. So the game sort of tunes itself to what you want it to be,' says Chey.

'BioShock's going to be plenty long enough, believe me.'

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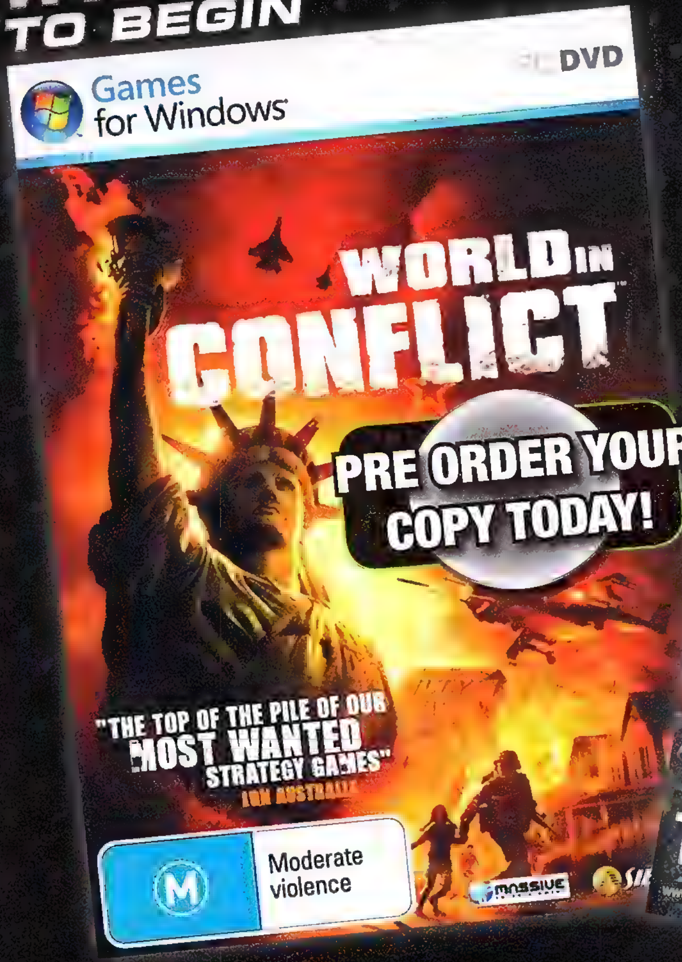

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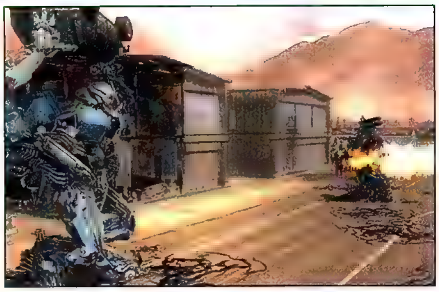
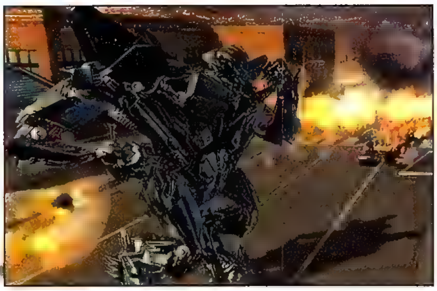




Transformers: The Game

There's less that meets the eye, says **Logan Booker.**

First thought to hit the brain is that the in-game models look truly sexy – as they should, being scaled-back versions of the ones from the movie. This thought is quickly displaced by a second: Running around, transforming from robot to vehicle and back is slick, fun and funky. Twenty minutes in you're struck with a final stream of consciousness. Does it hold further nuggets of gaming gold?

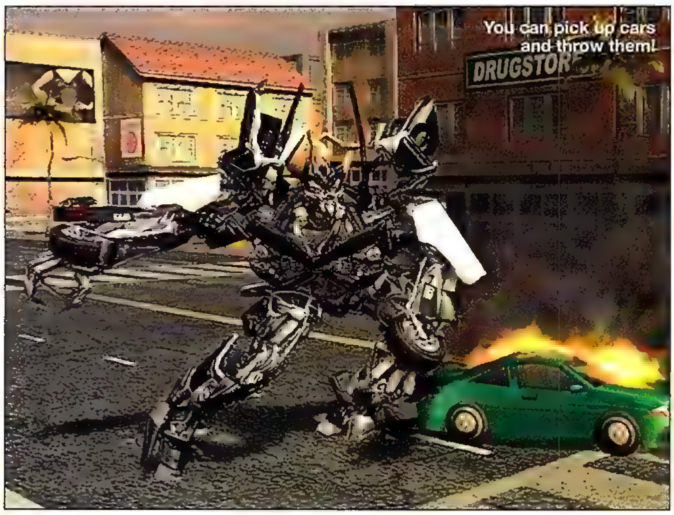
Sadly it doesn't. Instead the stream is filled with the putrid stink of something gone bad. Closer investigation will prove it's not your socks or a forgotten cheeseburger hiding under the couch – it's the gameplay of Transformers: The Game.

Whoever thought of mixing robots with Rampage and Grand Theft Auto needs to be disposed of, silently, because if this game is anything to go by, the formula just does not work.

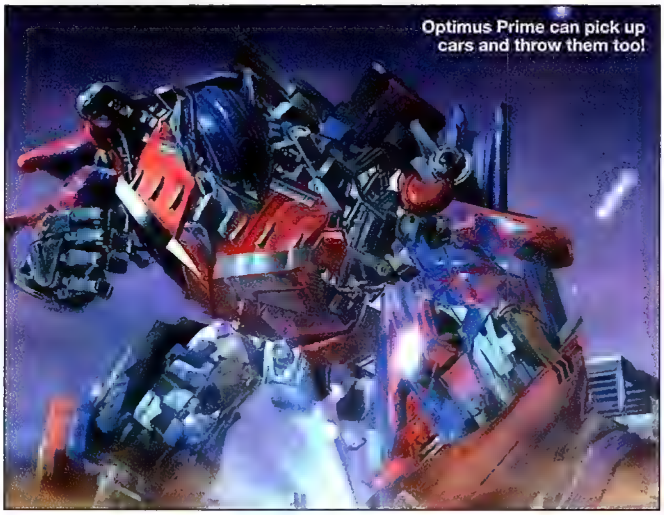
An elaborate intro cinematic, courtesy of the renowned Blur Studios, informs us that the AllSpark, a powerful artefact that grants the Transformers life, has arrived on Earth after years in hiding, and must be kept away from the evil Decepticons. The game then gives you the choice to play as either the Decepticons or the Autobots, however the format of the latter reeks distinctly of tutorials, while the former has you blowing up military bases and chasing down humans against short time limits from the get-go. The designers obviously believed players would go with the Autobots first and, if you chose not to, expect to learn by doing.

Playing the game isn't exactly complex though. The right trigger and bumper fire are your primary and secondary weapons respectively, with the secondary being the stronger of the two. 'X' jumps, while 'A' punches and kicks, and hitting 'Y' will convert you between bipedal and vehicular forms. The left trigger provides a turbo when you're driving. Get these down pat and you're done.

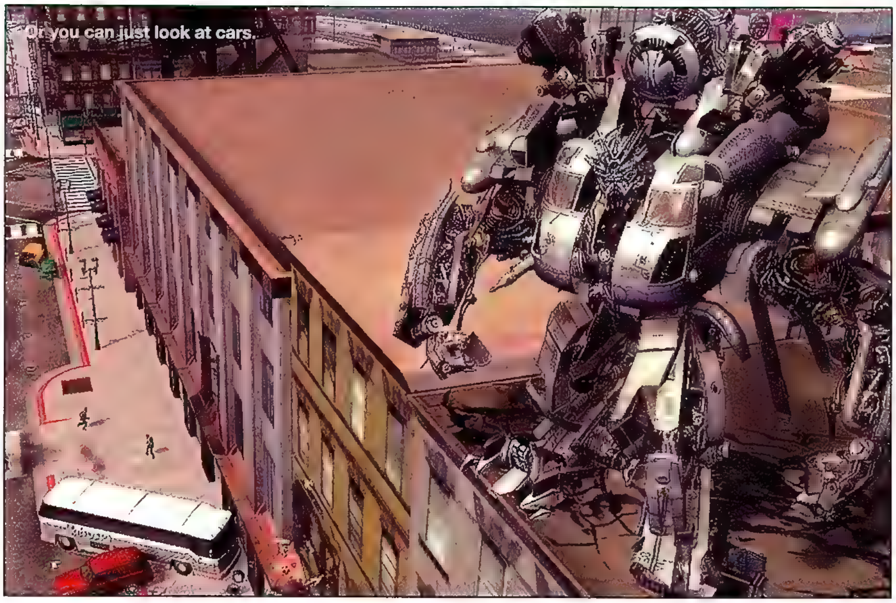
Transformers adopts an odd structure for its missions. It attempts to combine the freeform mechanics of GTA, where you're free to take on whatever tasks you choose from a plethora of options, with a standard, linear story more fitting of an action title. The problem is you're only ever given a single new mission to complete once the previous one is done, making the interludes



You can pick up cars and throw them!



Optimus Prime can pick up cars and throw them too!



Or you can just look at cars.

between the height of irrelevance. True, you can drive around the city picking up energy cubes that access extra 'content' – because getting every last movie screencap is the definition of compelling gameplay – and perform 'mad' stunts by kicking in the turbo, but ultimately your efforts are completely forgotten as soon as the next mission starts.

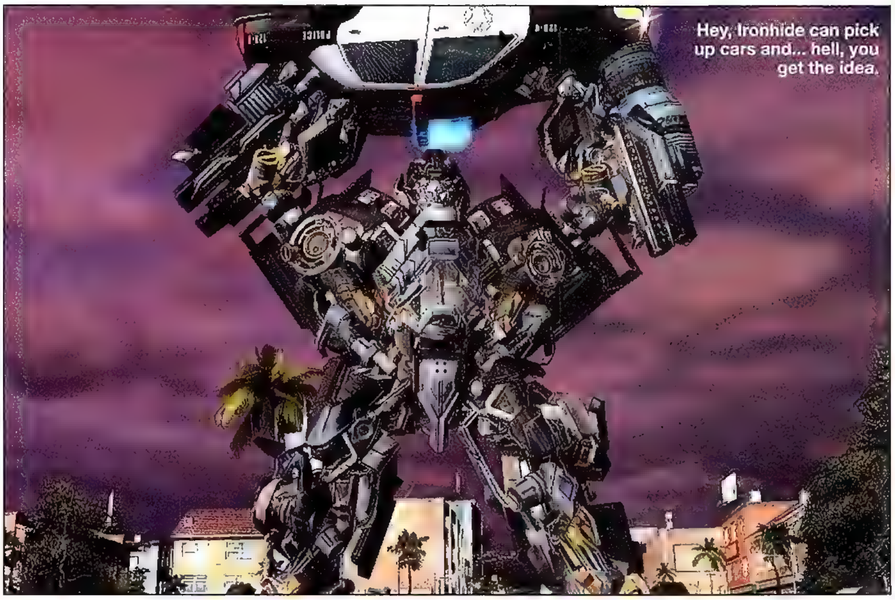
On top of this is the annoying way in which boss fights play out. Should one employ a bit of strafing combined with intelligent use of your Transformer's primary weak weapon and more potent secondary? Are you kidding? Just run around like an idiot trying to pick up a lamppost or tree to peg at them, and then close in for a few rounds of punching and kicking, and repeat. This would be fine if only a few boss fights required this strategy, but pretty much all of them demand you follow this unexciting and frustrating formula.

It doesn't help that when your robot has nothing near him to grab, pressing the 'B' button will still make him pause, crouch down and swing his hands about, only to stand up empty-handed, giving your opponent ample time to pound you. And even if you're off by a few millimetres or the object you want to wrench free isn't directly in front of you, poor Bumblebee, Blackout or whichever bot you're playing will waste precious seconds pushing around oxygen molecules.

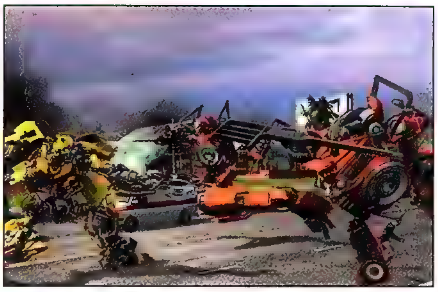
Finally, divine intervention is better than raw skill when driving, as the larger Transformers all but block your view – Optimus is a prime offender here – and there's only one camera view available. Seeing as it's not from the driver's seat, it's really unforgivable.

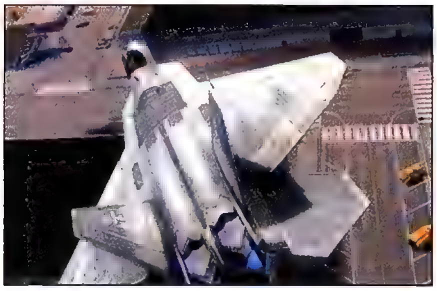
Were the developers given the high-polygon models from the film and told, at gunpoint, to make a game out of them? Because that's what Transformers: The Game plays like. It's truly an abysmal effort that will unfortunately spread to almost every console available.

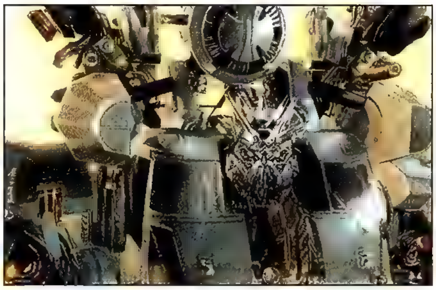
For heaven's sake, go see the movie instead.



Hey, Ironhide can pick up cars and... hell, you get the idea.







XBOX 360

Developer Traveller's Tales
Publisher Activision
Website transformersgame.com

Players 1
Other platforms PS3, PS2, PC, Wii, DS, PSP

VERDICT

✓ Awesome-looking models; unique convert forms and weapons.

✗ Repetitive; simplistic; annoying grab move; throwing solves everything.

SCORE 5.5 OUT OF 10

The Darkness

Logan Booker can't see what he's doing.

The Darkness is brought to us by the kindly folk at Starbreeze. These are the same guys that made Chronicles of Riddick and beat id to the punch by not only outdoing the visuals of the famous developer's Doom 3 engine, but also arriving before it.

As you can expect then, we've been anticipating the release of The Darkness for quite some time, for we believed it would surely meet, or even exceed, the quality of Riddick. And now, here it is.

In some ways it's better. In other ways – most ways – it's not.

But the good stuff first.

The Darkness is based on the Top Cow comic of the same name, and follows the antics of Jackie Estacado, a hit man for the Franchetti mob. Jackie, although adopted, is still considered a part of the family until Paulie, the Franchetti crime boss, decides Estacado poses a threat to his leadership and orders him killed.

It's at this stage of Estacado's life that he discovers that his body harbours a powerful supernatural force known as The Darkness. Apparently it's as old as time itself and can kick major arse – as long as it has darkness to feed on. The game starts with Estacado celebrating his 21st birthday, which also happens to be the same age The Darkness imposes on Estacado's daily activities.

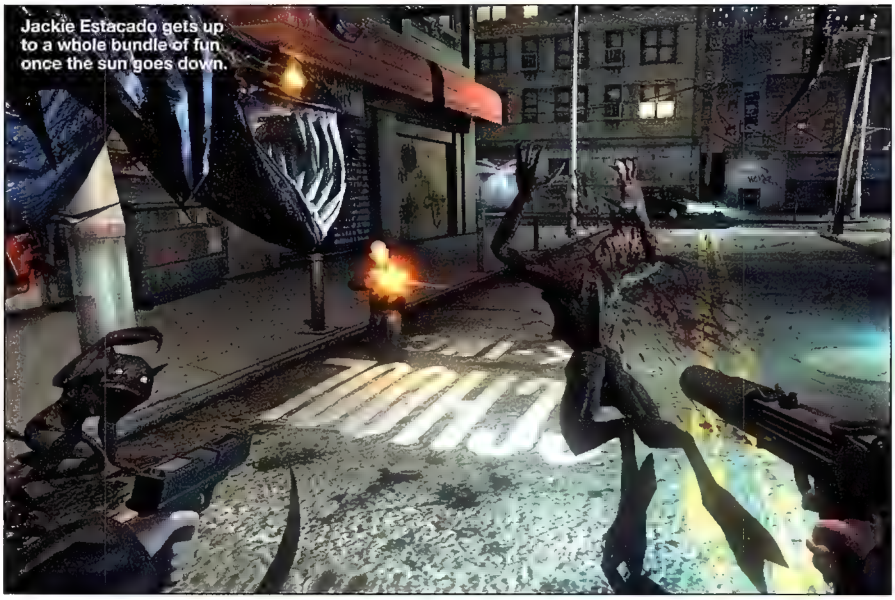
The Darkness is a first-person shooter through and through, yet it tries, unsuccessfully, to pose as a sort of role-playing game as well. The methods in which it conducts this is by providing compact dialog trees to a few characters, a levelling mechanic for The Darkness powers and optional 'quests'.

Except the levelling mechanic consists of eating the hearts of your dead enemies and you don't get to pick which powers you receive when you level – you just get them. Not that it matters, as there are only four levels and you seem to be granted powers in between these levels anyway. Talking is only useful in a few instances, and even then violence will solve every problem you encounter, while the side quests have no impact whatsoever on the story or your character's progression. Playing through the game, we couldn't help but shake our heads at the inclusion of these elements.

The Darkness' other failings relate to dialog and the quest mechanic. The lip-syncing, especially on Jackie, is woeful. A lot of the time our protagonist will stand there with a monologue in full swing, and his lips will barely move. Although minor, it detracts from what are otherwise brilliant visuals.

As for quests and the plot in general, the game is extremely vague about telling you where you need to go next. This doesn't combine well with the fact that you can travel almost anywhere in the game right from the start, and while freedom is good, a lack of direction is not. Actually, the freedom isn't that great, as all it does is change the order in which you complete the story, and not the story itself.

If we ignore these fantastic examples of poorly-thought out functionality, The Darkness is an extremely console-friendly FPS and excellent fun to boot. The start of the game has you armed with a pair of pistols, fired by pressing the left or right triggers, but within the first 15 minutes, you'll be awarded your first set of otherworldly powers. One example is Creeping Darkness, which lets you control a remote tentacle with teeth that can kill enemies in one hit, open doors



Jackie Estacado gets up to a whole bundle of fun once the sun goes down.

Not bullet-time, just normal time.

and retrieve items like keys. Another early power allows you to summon a Berserker darkling that's very adept at cutting throats and, in later levels, sawing off heads.

As the game continues, you'll be able to create guns out of shadow, command a giant tentacle to impale enemies, create a swirling vortex that crushes whatever is nearby and summon darklings that kamikaze, shoot miniguns and destroy lights.

Why would you want to destroy lights you ask? All of the above powers drain your darkness gauge, represented by glowing streaks on the tendrils of The Darkness. Once the gauge runs out, you won't be able to use any of your abilities. Standing in the shadows will replenish this supply while loitering in the sun or under lights will suck you dry.

The powers are done exceptionally well, and once you've spent 10 minutes with a new ability you'll have it down pat. Firing at one opponent, while flinging out a tentacle to stab someone else and toss them like a piece of trash becomes second nature in the latter parts of the game. The tentacle is even context-sensitive – aim it at a light and it'll flick out and smash it to bits.

As a plain old first person shooter, The Darkness is a success, packing in neat and useful powers, smooth gameplay and gorgeous graphics. At eight to 10 hours though, it is brutally short. We can't help but think if Starbreeze had dispensed with the lacklustre RPG elements, it could have squeezed in at least another five hours, perhaps more.

If it's lurking in the shadows it's probably worth shooting at.

XBOX360

Developer **Starbreeze**
Publisher **2K Games**
Website **www.2kgames.com/thedarkness**

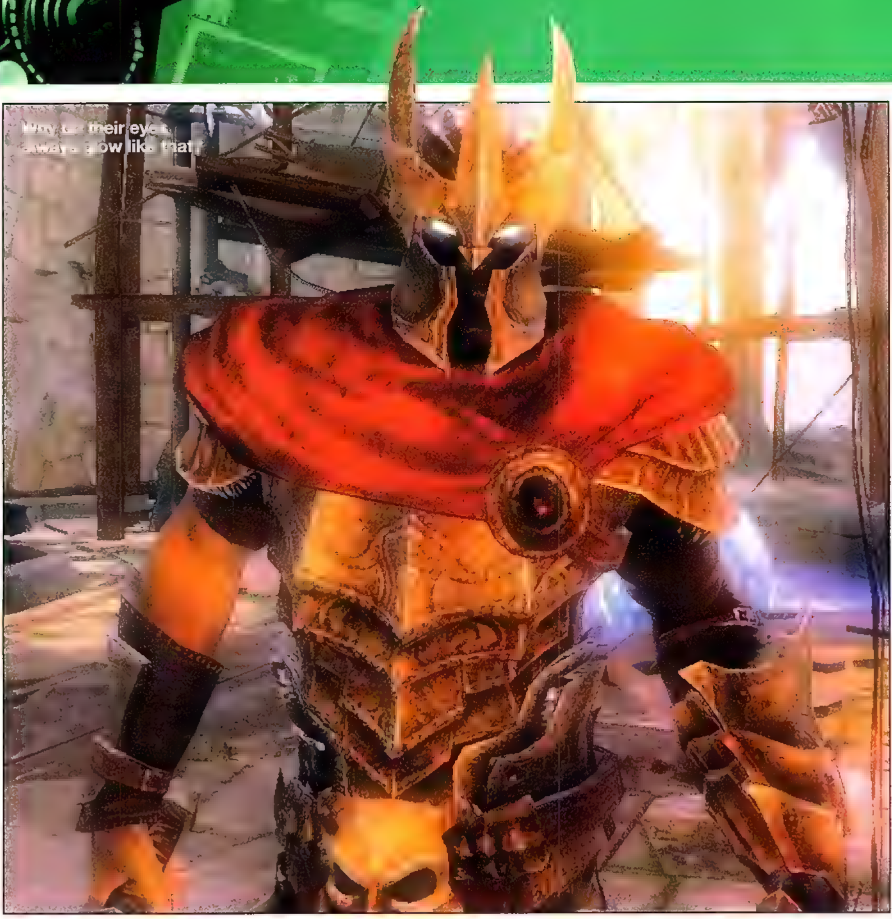
Players **1-8, Xbox Live**
Other platforms **PS3**

VERDICT

✓ Visually impressive; Darkness powers very user-friendly; dialog and story first-rate.

✗ Lip-syncing and character faces need work; easy to get lost; pointless quests; short.

SCORE 7.5 OUT OF 10



Why do their eyes always glow like that?

Overlord

The only slightly evil **David Kidd** gets a bit more evil.

Overlord is one of those few games that puts you on the dark side. It's theme is similar to Elixir's Evil Genius and Bullfrog's Dungeon Keeper series, and just like its ilk, it's more of a parody than a bona fide 'evil simulator'. The similarity ends there, though, because at its core, it's a strict, third-person action game.

You're an unnamed bad guy, resurrected by a creepy old demon to restore evil to the land. You'll work your way through branching quests across smallish localised maps, all the while hunting for items to decorate or improve your tower. Even though you're an axe-wielding, spell-casting super-villain, your main tool of conquest is actually an army of cheeky minions – obedient, psychotic goblins that tear the place up, loot buildings and harass sheep.

Here, Overlord offers something new over other third-person action games. You just target something in the world around you, throw a handful of minions at it, and they'll scamper off and perform whatever they need to. If you point at a fat little hobbit in a pumpkin patch, your minions will hunt him down and most likely smash up his prize pumpkins. If you target a building, they'll pour in through the door, set fire to it and bring you any treasure they find. They're not totally selfless, though. If they see something they can use as a weapon or armour, whether it's a zombie arm or said prize pumpkin, they'll equip it and increase their base stats.

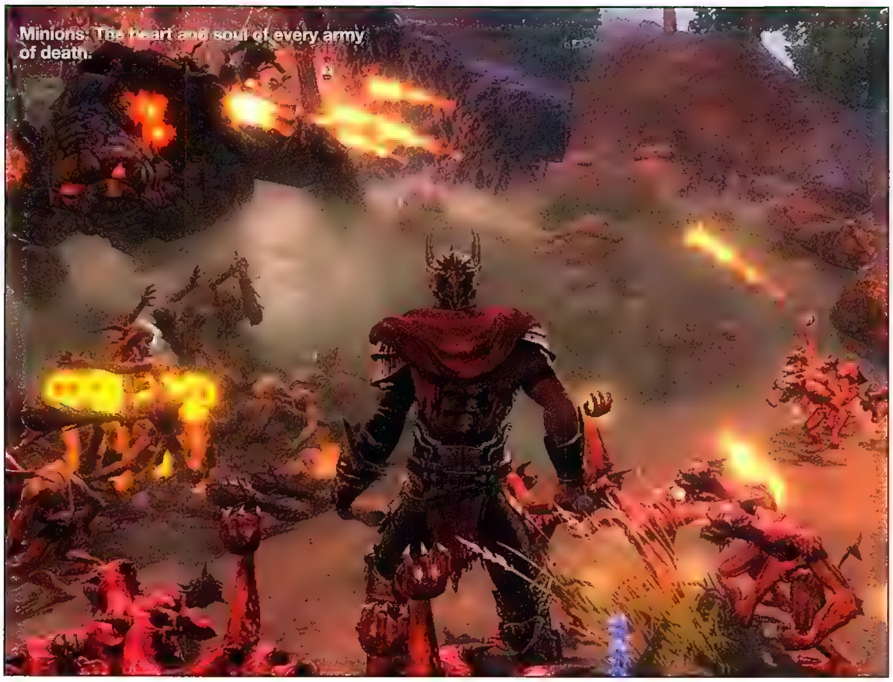
Aside from the 'browns', or bruiser minions, there are three other types: Blues, reds and greens. Reds lob fireballs from a distance and can walk through fire; blues can swim and resurrect recently fallen minions; and greens can backstab boss enemies, hide in stealth mode and withstand poisonous environments.

Waypointing brings a tactical element to the game. Rather than having all your minions throw themselves into the fray, you can set markers on the ground to have them wait or ambush. For example, you can put your reds on a hill to throw fireballs, have the browns charge up the middle, keep a couple of blues hanging back for resurrection, and have the sneaky greens waiting in the corner to jump out and stab the big guys in the back. When it works, it's enormously satisfying.

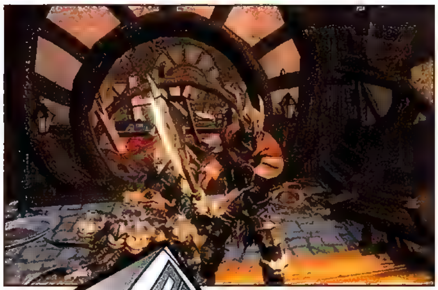
You'll also need your minions for more than combat. Most quests require capturing a device or treasure and sending it back to your tower, and you'll need a set amount of minions to lift it and take it to a portal. These objectives bring a puzzle element to the game, where you'll likely need more than one type of minion to succeed.

Controlling an army of different types of minions, in realtime, from a third-person perspective, while casting spells and swinging an axe might sound like a recipe for disaster, but Overlord's slick interface holds it all together.

Minions are controlled by the mouse, where the scroll wheel selects type, and a left click sends the minions to perform whatever contextual behaviour is required on the target. A right click calls them back, and if you want to take direct control over a group of minions, just hold both buttons to turn your minions into a



Minions: The heart and soul of every army of death.



tightly unified mob, then 'sweep' your mouse to the destination – indispensable when navigating precarious paths.

One area where Overlord is lacking is, in fact, its goodness. Despite the looting and pillaging, you're not really all that bad. The bosses you vanquish are often more evil than you are, and you're rarely given the opportunity to do something evil, like destroy an entire township. Still, Triumph Studios subtly acknowledges that you're being pushed into 'good' directions, with much of the humour centring on how thankful your subjects are to be in the midst of such selfless benevolence.

The overall style, writing, and visual design help move the game along at a cracking pace. The combat isn't particularly deep, the puzzles are a little light, and you'll be begging to break free from the third-person to get more tactical control, but there are so many interesting small touches that keep you going when the action loses steam. For example, if you want to customise your tower, you can buy embellishments, statues or decorations. If you want to get closer to the action, you can forge new armour and weapons, imbuing them with special powers from sacrificed minions. You can even try out some new tactics by heading down to your dungeon's combat simulator and battling against any enemy you've encountered.

Overlord isn't totally unique – if you've played Nintendo's excellent Pikmin on the GameCube, you'll be right at home – but Triumph Studios has worked exceptionally hard at packing in as much content and gameplay as possible. It's not perfect, but it's a genuinely funny, light-hearted romp that will keep you grinning like a madman for hours.

Developer **Triumph Studios**
Publisher **Codemasters/Atari**
Website **au.codemasters.com/overlord**

Recommended **Windows XP; 2.4GHz CPU; 1GB RAM; 2.5GB HDD; DirectX 9.0c graphics.**

VERDICT

✓ Fun and funny; simple gameplay and UI; nice art direction.

✗ Slightly repetitive; lacks depth; restrictive third-person camera.

SCORE **8.0** OUT OF **10**

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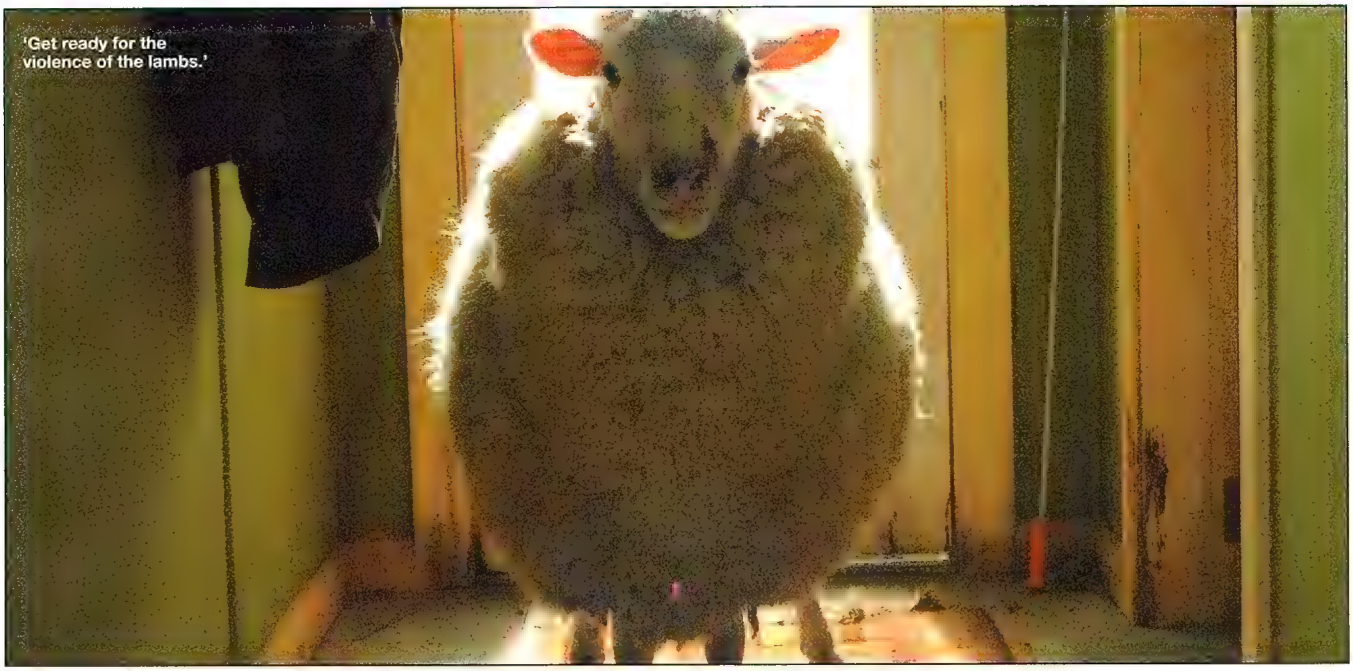


Black Sheep

CINEMA Distributor Icon Films Web www.blacksheep-themovie.com
Director Jonathan King Starring Nathan Meister, Danielle Mason, Peter Feeney

Who would have thought that anything good could come out of combining the marvellous concept of a zombie apocalypse with New Zealand's national treasure, the sheep? Writer/director Jonathan King and his *Black Sheep* take hold of this very entertaining premise and, while a flick of decent quality is the result, it also serves to highlight King's inexperience with camera, pen and choice of performers.

Black Sheep's opening scenes – a flashback – introduce the viewer to the film's protagonists, brothers Henry and Angus Oldfield (Nathan Meister and Peter Feeney respectively). We're greeted by a calming sea of sheep, with Henry helping his dad round up the flock. It then cuts to a house with a sheep, which we later learn is Henry's pet, tied to a pole outside. Angus approaches, axe in hand, and the outcome of the encounter is pretty easy to deduce.

Soon after, Henry returns to the house and begins calling for his animal companion, eventually searching a nearby, dark barn. Angus, who has thoroughly mutilated the sheep, surprises Henry from the shadows, sporting its bloodied hide as a cloak. Henry loses it, obviously, but the scene is roughly interrupted by the news that father Oldfield has died.

The next scene, taken from the present, has Henry stuck in a taxi, completely surrounded by the fluffy creatures. The man is terrified of their presence, and we can only attribute the run-in with his brother as the source of his paranoia.

From here we learn that Henry, now a city lad, has come back to the farm to sell his share to the older Angus, who is soon to debut a new species of sheep, aptly named the Oldfield. At this point, the story starts plummeting into the bizarre – Angus has been playing with genetics and two environmentalists are onto him. Their subsequent mischief sparks a chain reaction that quickly has the whole sheep population of the farm hungering for human flesh.

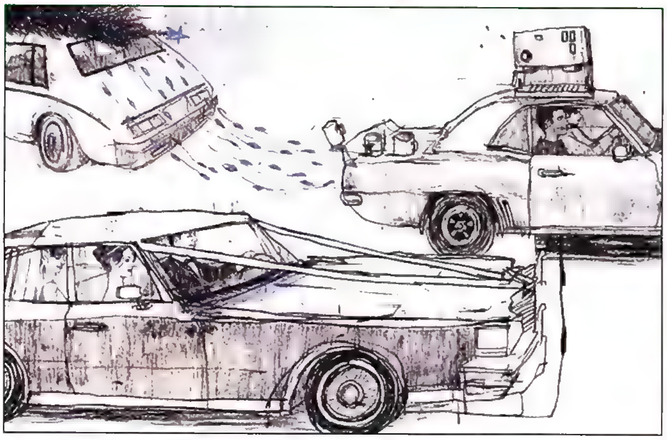
The most glaring problem with *Black Sheep* is its inability to be either just humorous or just serious. King attempts to blend both together and although it works in many places, it fails almost as often.

Whereas Sam Raimi's *Evil Dead* series is unquestionably camp, *Black Sheep* is everywhere tone-wise. For example, one scene has the Oldfield brothers discussing – in all seriousness – the future of their father's farmland, while in another a zombie sheep grabs hold of a character's penis and pulls it out to a ridiculous length. It is extremes such as these that make the film confusing to watch. It's also for this reason that more than a few of the gags fall flat on their face.

It doesn't help that Meister and Danielle Mason – who plays one of the environmentalists – are not the most convincing of actors. One can hardly blame them entirely however, given the flaccidness of the gags themselves, and to their credit, they improve as the film goes on.

Our recommendation is to take nothing in the film seriously, despite what the actors and ambience may otherwise suggest. With some solid decision-making on the tone of the film, *Black Sheep* could have been a classic. **LB**

score **7.0** OUT OF **10**



Rant

BOOK Publisher **Jonathan Cape** Author **Chuck Palahniuk**

Chuck Palahniuk was great – until *Diary* and *Haunted* came along. They weren't very good. And so we approached this new book, *Rant*, with trepidation. *Rant* is an 'oral biography' of a very self-destructive, very dead young man named Rant. In other words, Rant never narrates. Rather, his friends, relatives and neighbours do. As you'd expect, their stories often contradict each other. The format works well, much like it did in Max Brooks' brilliant *World War Z*.

The tales of Rant's childhood are pretty funny, although the humour is mostly of the toilet persuasion. There's absolutely no substance to the plot, but it's a fun read nonetheless. The sci-fi flavouring works reasonably well, mostly because Palahniuk uses it sparingly. Still, *Rant* isn't without its faults. At about page 200, things start to go awry. The conclusion is drawn out and left us feeling unsatisfied and cheated of something. It was like Palahniuk was itching to leave *Rant* behind and start a new project. We could see where he was driving the story, but he fell short of his mark.

With its futuristic trappings and weird format, *Rant* could've been a disaster. But while it is flawed, on the whole it's competent and a vast improvement over the trite that was *Haunted*. We just hope that his next book, *Snuff*, is as good as his older works, particularly *Fight Club* and *Survivor*. **CT**

score **7.0** OUT OF 10

Deadwood The Complete Third Season

DVD Distributor **Paramount** Director **Various** Starring **Brian Cox, Ian McShane, Timothy Olyphant**

We loved *Deadwood*. The third and unfortunately final season has just come out on DVD. It kicks off right where the second season left of, with democracy, law and order encroaching on the violent mining town.

From the word go we're introduced to new characters and conflicts, most notably between the dastardly George Hearst and the town's original inhabitants. Highlights include the showdown between Dan Dority and Hearst's bodyguard, and the arrival of Swearengen's eccentric and likeable friend, Jack Langrishe. The relationship between Swearengen and Langrishe – seemingly complete opposites – is great. If nothing else, season three proves that Ian McShane and Brian Cox are brilliant actors.

It's not all gold, though. The decidedly anti-climactic finale has been the butt of a lot of criticism. But as disappointing as it was, we're not going to be harsh on creator David Milch – when he finished it he still thought HBO was going to give him another season. Apparently he's planning a two-part telemovie, although realistically, considering he's moved onto a new show – *John From Cincinnati* – we can't see it happening any time soon.

But maybe that's a good thing. Perhaps *Deadwood* should be left to rest, to be remembered for what it was – three seasons of spectacular, edgy small-screen storytelling that, sadly, concluded poorly. **CT**

score **8.0** OUT OF 10

ANIME OF THE MONTH

Your regular dose of anime goodness courtesy of our resident expert Ammina Soemino.

Jin-Roh: The Wolf Brigade

Studio **Production I.G.** Distributor **Madman** Web **madman.com.au** Price **$29.95**

Jin-Roh: The Wolf Brigade is set in an alternate post-WWII reality, in which Japan lost to Germany. During a raid, Kazuki Fuse, a member of a counter-terrorism force, the Capital Police Special Unit, runs into an adolescent girl who is a suicide bomber. After staring into her pretty eyes, he hesitates to kill her and, in a move that makes the Al-Qaeda look like Hi-5, she blows herself to pieces, taking Japan's electrical power with her.

Kazuki becomes obsessed and, oddly, hooks up with the girl's sister, who he meets by chance at the dead girl's grave. This love story is a contrast to the power struggle between the police and the vigilante terrorist group, the 'Wolf Brigade'.

Although we loved the variety of influences, the story bogs itself with a series of betrayals among indistinguishable political factions. It spends too much time on unrewarding symbolism rather than explaining character. The animation however does stand out and works well with the magnificent score. Coupled with a good climax, we highly recommend it.

score **8.0** OUT OF 10

GEEKETTE

A girl's eye view of the gaming world

Clique here if you're hardcore

Kate Inabinet just wants to be casually accepted.

Within us all is the need to belong. You first become aware of it in high school, as you gaze about the home-room on that dreaded first day, trying to work out which group you fit into.

Are you sad and pale enough to write poetry and debate suicide tactics with the emos? Is it humanly possible to maintain a proper commitment to truancy and pyromania to make an impression on the cool kids? If the circumference of your neck is actually smaller than that of your head, will you be rejected by the jocks?

Game culture is not so different to high school as you struggle to identify with the right clique, but trying to work out if you are a casual or a hardcore gamer is harder than all the puzzles in Big Brain Academy combined because two broad definitions don't accurately cover all aspects of gaming habits.

A casual gamer is someone who either plays games sporadically, or plays 'casual' games like Solitaire on the PC or Wii Sports. Games that have simple rules and can be played in short bursts.

Hardcore gamers, on the other hand, have traditionally been the people who are very passionate about not only the amount of time spent playing games, but the games themselves. Someone who plays The Sims for example, even if they play it every night after work, is never going to be considered hardcore like someone who plays Gears of War all weekend, even if the hours add up to be the same.

> “Are you only truly hardcore if you spend a week without eating, sleeping or going to the toilet?”

But is a casual gamer someone who plays casual games? Or someone who plays games casually? If you casually walk up to the computer, and indifferently flick the on button, then nonchalantly throw yourself into the chair and settle in for the next 12 hours of dungeon raiding in WoW, does that make you a casual hardcore gamer?

If you come screaming into the room, commando roll up to the console, fire it up and then perch on the edge of the couch hitting yourself in the head with the controller until the game starts only to play Katamari Damacy for half an hour before your friends arrive to pick you up for a night out, does that make you a hardcore casual gamer?

Does being a hardcore gamer mean you play games all of the time, or do you have to play specific types of games? Can you be hardcore if you hold half a dozen accounts of the same game or does the title only apply if you reach the highest possible level that a game can offer in the shortest possible time frame?

Is being hardcore having a tag, commenting on forums and being up to date on all the latest releases, or are you only truly hardcore if you spend a week playing games without eating, sleeping, or going to the bathroom until you die to the tune of your organs failing in a series of meaty pops?

I never thought of myself as a hardcore gamer, but neither do I seem casual. The minute I come home my cats greet me briefly at the door before charging straight into the study – conditioned like Pavlov's dogs as they are – with the knowledge that the computer means endless hours of uninterrupted lap-time.

I play my favourite MMO in my lunch breaks at the office and even though I work with game developers, it is most often *my* name that is bandied about when discussing 'game pushers' among colleagues. No tram trip is spent without my trusty PSP, Game Boy or DS, and hooked up to my TV is a GameCube, PS2, Xbox and 360, all with a fancy little switch-doohickey so I can easily flick between them without having to unplug one or the other.

Yet, the very second that LittleBigPlanet hits the shelves I *will* make room among the tangled cords for the PS3. Shelling out $1000 on a console so I can play a single game on it? Now *that* I could consider hardcore.

Reckon you're more hardcore than our Geekette. Send her an email and set her a challenge.
geekette@atomicmpc.com.au

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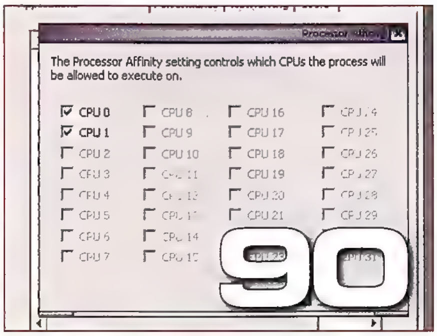
TECHNIQUE

HANDS-ON TUTORIALS FOR THE TECHNICALLY INCLINED

Join us this month as Leigh Dyer keeps at it with the 'Making music in Linux' tutorials. If you caught part one in the last issue, no doubt you'll be hungry to get at part two. And guess what? It's on the next page. All you have to do is flick!

We understand that not everyone wants to be a maestro, so Jake Carroll went to the effort of pulling apart Windows and figuring out the best ways to put it together again for Core 2 and Athlon X2 PCs. You can find his work on page 90. Finally, and keeping with the sheep theme of this issue – well, sort of sheep theme if you've read Culture Shock – take a look at Lambo's case mod on page 96. Functional art if we've ever seen it.



The Processor Affinity setting controls which CPUs the process will be allowed to execute on.

☑ CPU 0
☑ CPU 1
☐ CPU 2
☐ CPU 3
☐ CPU 4
☐ CPU 5
☐ CPU 6
☐ CPU 7
☐ CPU 8
☐ CPU 9
☐ CPU 10
☐ CPU 11
☐ CPU 12
☐ CPU 13
☐ CPU 14
☐ CPU 15
☐ CPU 16
☐ CPU 17
☐ CPU 18
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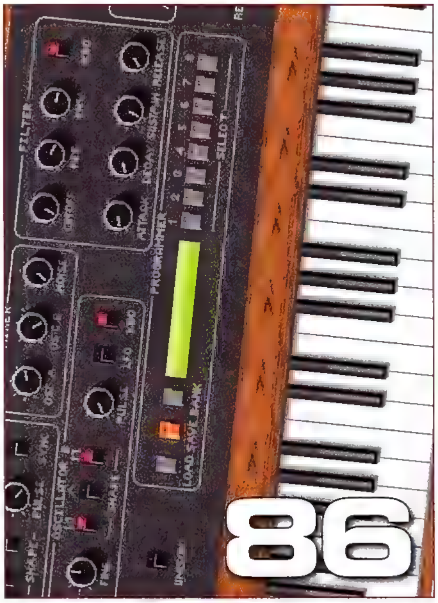
☐ CPU 29



TECHNIQUE CONTENTS

Making music in Linux, part 2 86
Leigh Dyer is at it again, blasting tunes from his open source box. Join him in the continuation of his tale.

Optimise Windows for dual-core 90
We did it with Linux – now it's time to make sure your XP and Vista systems are kicking the crap out of your multi-core hardware.

Input Output 94
When will Dan Rutter stop answering all those tough questions? Never, that's when.

Hotbox 96
Another sublime and beastly modded case for you to gaze on and desire. Ravenously.

Fallout 98
It's the world after the war, and Logan Booker is just trying to survive. He's even willing to give up his hat.

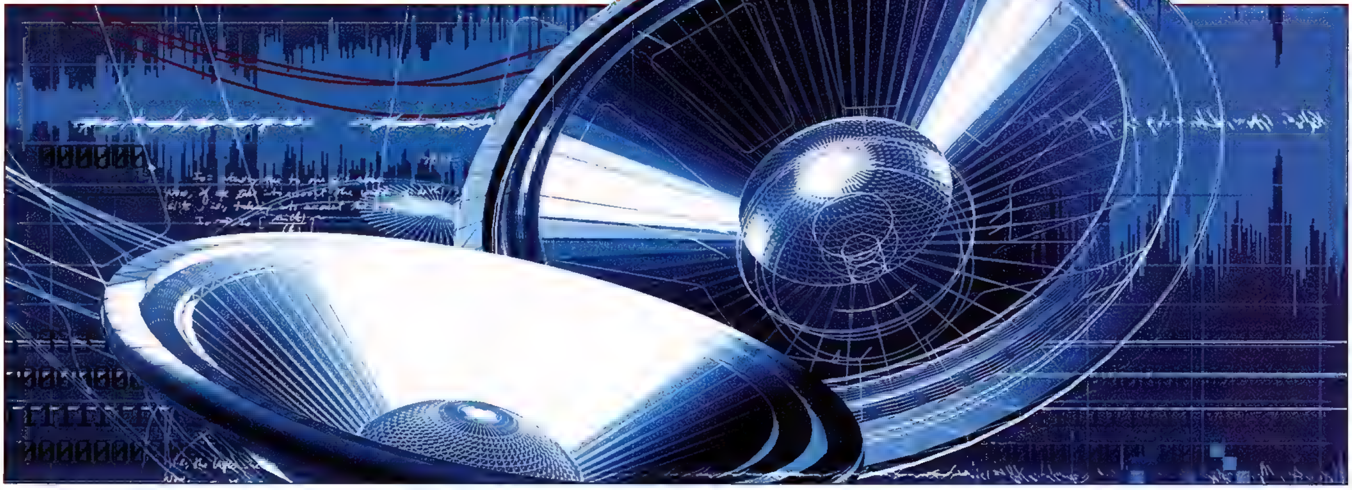
Have an idea for an *Atomic* tutorial?

Then send an email to lbooker@atomicmpc.com.au!

When it comes to tutorials, *Atomic* likes to tackle the hard stuff. If it's not hard enough, we just don't do it. Alright – that's not necessarily true, because every once in a while, we like to cover the easy tutorials too. Not so much easy as basic, you know... building the skills, the foundations you need so you can have a go at those tricky tutorials.

We know that techniques change, as does technology, and guides that might have been useful a few years ago can be close to useless today. So, if you have an idea for a basic tutorial, like soldering, water-cooling or harpooning whales even, let us know.

Now go email!



DIFFICULTY **EASY** ●

Making music in Linux, part 2

Leigh Dyer keeps on banging out those sweet, open source tunes…

We ended last month by pushing our JACK server to real-time priority, which dropped our audio latency from a noticeable 50ms to a virtually inaudible 11ms. However, under certain usage patterns, this latency can accumulate across tracks, potentially becoming a problem on some of them. To prevent that, it's time to push further: Down to 2-3ms, and perhaps even lower. The key lies in kernel preemption, a feature added in Linux 2.6 that lets the kernel interrupt a task even if it's making a kernel-level system call. It's easy to see that, without this, you'd be in a world of pain if there was just a single task making a system call when JACK needs its slice of CPU time. Most distributions now enable kernel preemption in their desktop kernels because it makes the system feel more responsive, and it's because of this that you can get 11ms latency without much effort.

These distribution kernels stick to the quite safe 'voluntary' preemption mode, which only preempts certain system calls that are known to be completely safe. For super-awesome realtime performance, you need the real-time preemption mode. It's maintained by Red Hat hacker Ingo Molnar, and distributed as a set of patches because it's all a bit too crazy to go in to the mainline kernel. It may open you to some stability issues if you're unlucky, but it's designed to handle embedded systems with strict real-time requirements as well as music desktops, so the results are impressive.

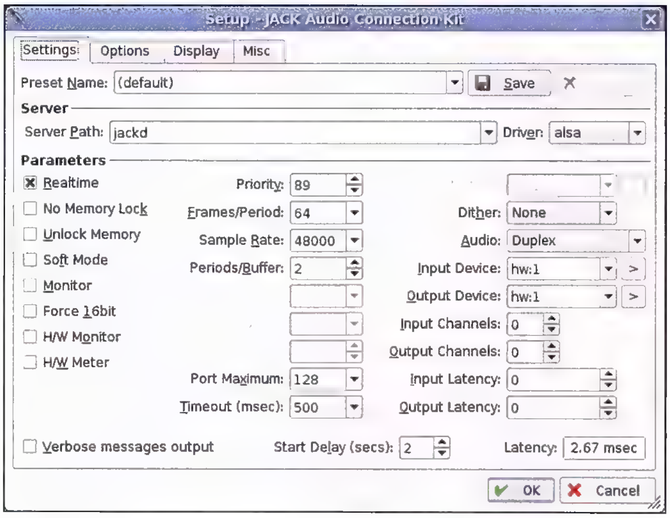
Getting the patch installed means building a kernel, but for some distributions the job has already been done. For Fedora users, Molnar has his own kernel packages available from his site (**people.redhat.com/~mingo/realtime-preempt**). On a Gentoo system, it's not too tricky to apply the real-time preempt patch to your kernel and rebuild.

On Ubuntu, the UbuntuStudio project is aiming to have a 'real-time' kernel included in the main tree in time for the next release. In the meantime, there's a beta kernel available for Feisty. Add the following line to your /etc/apt/sources.list file:

```
deb http://www.texware.it/ubuntu feisty/
```

Then run these commands to install the new kernel:

```
sudo apt-get update
sudo apt-get install linux-realtime
```



Preset Name: (default)

Server

Server Path: jackd
Driver: alsa

Parameters

☒ Realtime
☐ No Memory Lock
☐ Unlock Memory
☐ Soft Mode
☐ Monitor
☐ Force 16bit
☐ H/W Monitor
☐ H/W Meter

Priority: 89
Frames/Period: 64
Sample Rate: 48000
Periods/Buffer: 2
Port Maximum: 128
Timeout (msec): 500

Dither: None
Audio: Duplex
Input Device: hw:1
Output Device: hw:1
Input Channels: 0
Output Channels: 0
Input Latency: 0
Output Latency: 0

☐ Verbose messages output
Start Delay (secs): 2
Latency: 2.67 msec

▲ **JACK configured to an impressive 2.67ms latency.**

Reboot into the new kernel and see how you go – with any luck, you should be able to run latencies into 2-3ms range with few, if any, xruns. If that's not good enough, there are some other tricks you can try to reduce your latency:

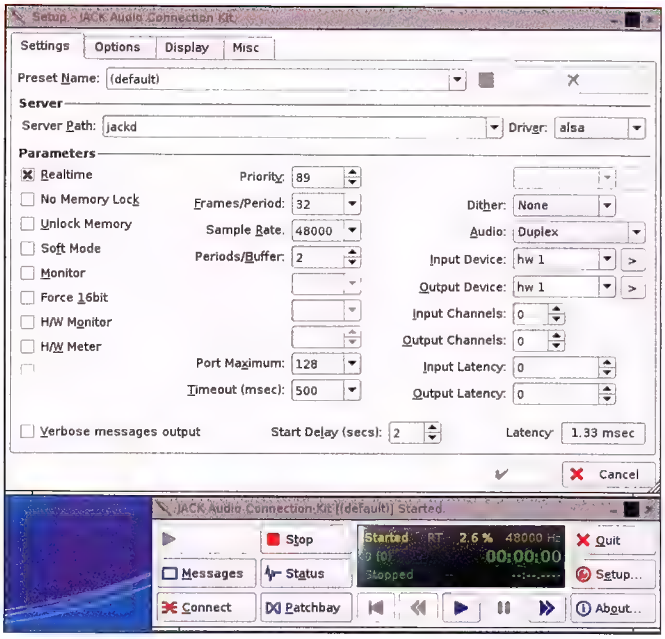
- Shut down any non-essential background apps. Firefox can use a fair bit of CPU time depending on the pages you have open, so close it if you don't need it. BitTorrent clients are good to shut down too.
- Cut down on the eye-candy, or switch to a lightweight desktop. A CPU meter updating twice a second may not use much CPU time, but it's just one more thing the kernel needs to schedule in. A nice barebones window manager like Openbox will free up both resources and screen real estate.
- Do some priority tweaking. The real-time preemption patch turns your system interrupts into tasks, and there's a script called 'rtirq' available from **www.rncbc.org/jack** that can tweak these to prioritise your sound card and system timers.

The 'rtirq' script doesn't work on Ubuntu because it can't find its config file, but this is easy to fix: Edit the 'rtirq.sh' file and change the line that begins with 'RTIRQ_CONFIG=' to read:

```
RTIRQ_CONFIG=rtirq.conf
```

You can then run the script with a 'sudo ./rtirq.sh' command.

With all these measures in place, we could run my system fine at a 48,000Hz sample rate with two 32-byte buffers, giving a latency of 1.33ms.


Setup - JACK Audio Connection Kit

Preset Name: (default)

Server

Server Path: jackd
Driver: alsa

Parameters

☒ Realtime
☐ No Memory Lock
☐ Unlock Memory
☐ Soft Mode
☐ Monitor
☐ Force 16bit
☐ H/W Monitor
☐ H/W Meter

Priority: 89
Frames/Period: 32
Sample Rate: 48000
Periods/Buffer: 2
Port Maximum: 128
Timeout (msec): 500

Dither: None
Audio: Duplex
Input Device: hw 1
Output Device: hw 1
Input Channels: 0
Output Channels: 0
Input Latency: 0
Output Latency: 0

☐ Verbose messages output
Start Delay (secs): 2
Latency: 1.33 msec

JACK Audio Connection Kit [(default)] Started.

Started RT 2.6 % 48000 Hz
0 (0) 00:00:00
Stopped

Even better: A few more tweaks got our system down to 1.33ms.

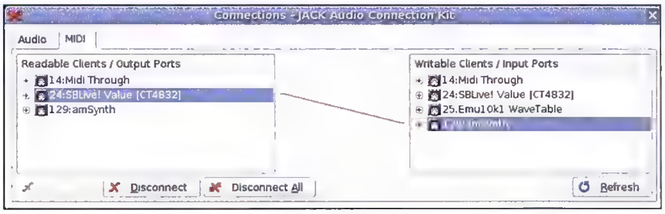
JACK's nice racks

Last month we touched on the ability to route audio and MIDI signals arbitrarily using JACK and ALSA, and we even used this to a degree from within the Rosegarden interface. Beyond that, though, there's an incredible amount of flexibility on offer in how you connect your software and hardware components together. For instance, instead of using one of the DSSI soft-synths built into Rosegarden, you may want to check out a stand-alone synth like amSynth – it's available in the 'amsynth' package on Ubuntu.

A neat analogue modelling synth, amSynth is good for those old school fat lead and bass sounds, and a range of other noises too. It's also fairly easy to get to grips with – its many knobs are logically arranged, so if you've ever played with a real analogue synth, it should all make sense. If not, there are always the presets, which are in a drop-down menu at the top.

If JACK is running when you start amSynth, it should detect it and automatically connect its outputs into your JACK audio outputs, so you should be able to hear the synth by pressing the 'Audition' button, which plays a single note. Eventually you'll need to hook up a MIDI input, whether it's from your (real or virtual) keyboard or from a sequencer like Rosegarden. To hook these up, find your QJackCtl main window and hit the 'Connect' button to open the 'Connections' window. Switch to the 'MIDI' tab, and you should see a list of your ALSA MIDI outputs on the left, with inputs on the right, and lines between them showing the connections from outputs to inputs. Select your virtual MIDI keyboard, or the MIDI interface connected to your real keyboard on the left, select amSynth on the right, and hit 'Connect'. Now, notes on the keyboard should push amSynth sound out through JACK to your speakers.

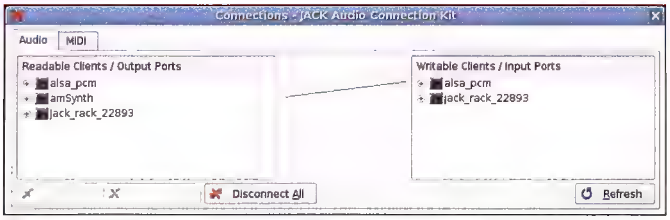
Of course, that amSynth sound could be even bigger with some effects applied, like a chorus or reverb. While amSynth has a built-in reverb, it's awful, so it's time to introduce another acronym: LADSPA, the Linux Audio Developers Simple Plugin API. This is an effects plug-in interface, similar to VST on other platforms, but it's supported by just about every Linux audio


Connections - JACK Audio Connection Kit

Readable Clients / Output Ports
14:Midi Through
24:SBLive! Value [CT4832]
129:amSynth

Writable Clients / Input Ports
14:Midi Through
24:SBLive! Value [CT4832]
25:Emu10k1 WaveTable

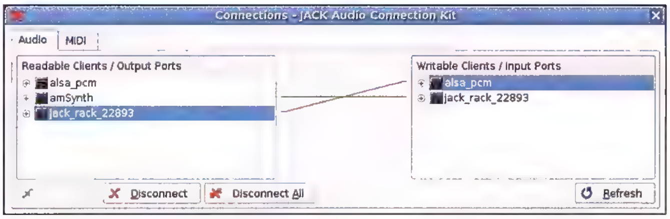
QJackCtl can control connections for audio and MIDI.


Connections - JACK Audio Connection Kit

Readable Clients / Output Ports
alsa_pcm
amSynth
jack_rack_22893

Writable Clients / Input Ports
alsa_pcm
jack_rack_22893

amSynth running straight to the sound card...


Connections - JACK Audio Connection Kit

Readable Clients / Output Ports
alsa_pcm
amSynth
jack_rack_22893

Writable Clients / Input Ports
alsa_pcm
jack_rack_22893

...and now, running through JACK Rack on the way.

app that has a need for effects processing. There's also a wide range of effects modules written as LADSPA plug-ins, usually distributed in collections.

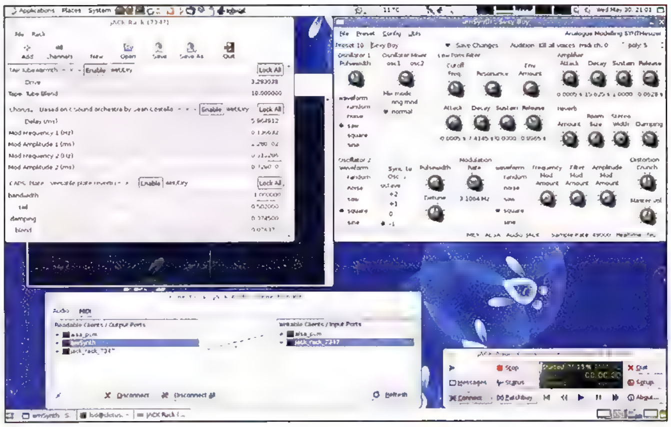
To spruce up our amSynth sound, we'll use some LADSPA plug-ins from the CAPS collection, hosted in JACK Rack, a virtual effects rack that allows you to push sounds through JACK. You can install these on Ubuntu with this command:

```
sudo apt-get install jack-rack caps
```

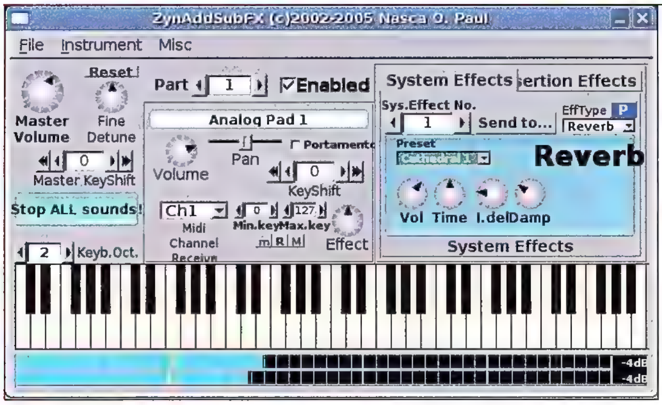
Run JACK Rack, click the Add button, and select 'Uncategorised/C/CAPS: Plate2x2' from the menu that appears. The controls for this plug-in – a nice plate reverb effect – will appear, and you can tweak them if you like, though the defaults will do for now. To hook it up to amSynth, open the QJackCtl Connections window again, and switch to the Audio tab – it's the same as the MIDI tab, but it lists JACK audio inputs and outputs.

Right now, you'll see amSynth on the left, connected to your sound card ('alsa_pcm') on the right. Select these two components, and click the 'Disconnect' button. Then, select amSynth on the left and the 'jack_rack' input on the right, and hit 'Connect'. Finally, select the 'jack_rack' output on the left and the sound card on the right, and hit 'Connect' again. This will route the audio from amSynth through JACK Rack before it hits your speakers.

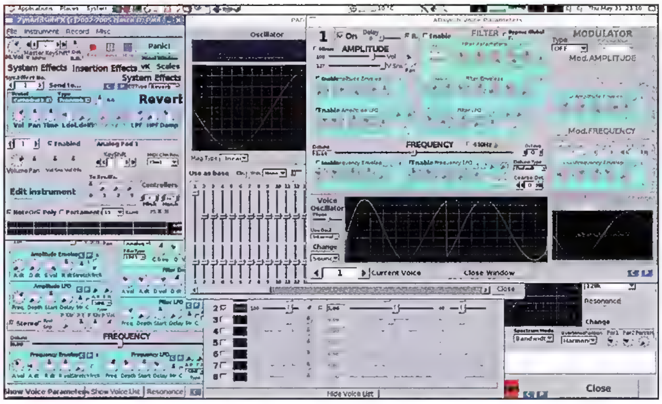
If you play some notes on the keyboard, they should sound the same as they did before, because JACK Rack leaves effects plug-ins in a disabled state when they're first added. Switch to the JACK Rack window, hit the 'Enable' button next to the CAPS: Plate2x2 plug-in, and try those notes again – the added reverb should be quite clear. From here, you can spend hours adding different effects in JACK Rack and tweaking their



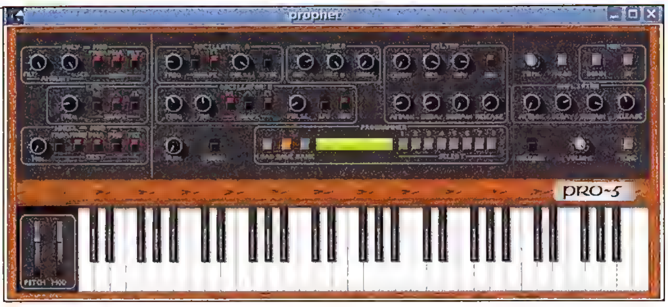
The complete amSynth/JACK Rack setup, with mountains of tweakability.



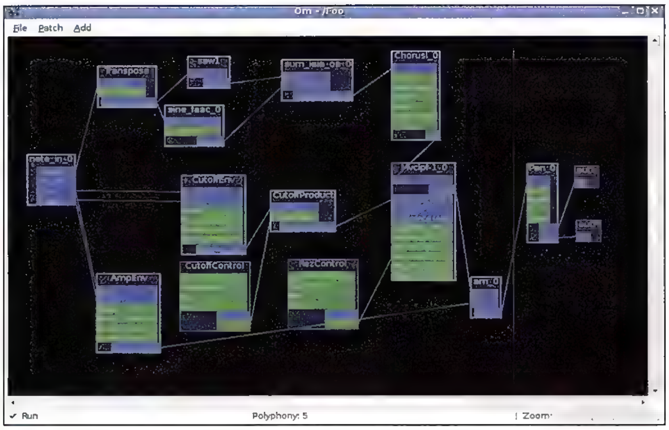
The ZynAddSubFX 'beginner' interface.



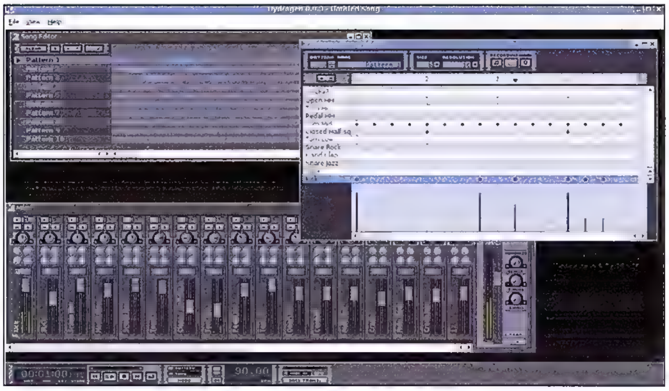
This is the 'advanced' interface... or at least, part of it.



Bristol's emulation of the once-groundbreaking Prophet 5.



Om: A big box of virtual synth components and patch cables.



Hydrogen makes drum programming easier than drooling on stage.

parameters while trying different options inside amSynth. There are some other great LADSPA plug-in collections too: A search of your distribution's package database should turn up quite a few, such as the CMT, SWH, and TAP collections.

More synthy goodness

Beyond the DSSI synths usable directly within Rosegarden, and versatile external synths like QSynth/FluidSynth and amSynth, there's a range of more complex and specialised software synths available for Linux. The oddly-named ZynAddSubFX (**zynaddsubfx.sourceforge.net**) certainly falls in to the 'complex' category – it's an incredibly powerful synth that combines a bunch of different ways of making sounds.

If you just want to make some sounds, ZynAddSubFX makes it quite simple, with its 'Beginner' mode that just lets you pick from the many preset sounds to play. If you want to edit sounds or create your own, you can switch to 'Advanced' mode, where a click of the 'Edit Instrument' button will soon see you spiralling uncontrollably through an endless stream of dialogs that let you tweak every aspect of the sound. Luckily for us mortals, the presets are nicely varied, and most sound great.

For vintage synth sounds, Bristol (**bristol.sourceforge.net**) is an interesting option. The user interface spends too much time looking like the synths being emulated and not enough time being genuinely user-friendly for our liking, and it can be a bit flaky at times, but the sheer number of synth emulations is amazing, from the Mini Moog to the Prophet 5 to the Juno-6, with a bunch of stuff in between.

Om is more our style – it's a modular synth, which means that it lets you build your own synth by connecting various modular components together. It can be a bit like putting together a jigsaw puzzle without the box, but if you know how a synth works, you'll soon be building all sorts of sounds. Om provides a few basic components, such as ALSA MIDI and JACK audio I/O connectors, but the rest of the components can be any LADSPA plug-in on your system, which gives you access to all sorts of filters, envelopes, and effects. To help out, there's an associated collection of plug-ins called Omins that are designed with modular synthesis in mind.

Om development has ceased, but its replacement, Ingen (**wiki.drobilla.net/Ingen**), isn't quite ready for prime-time yet. The basic theories involved are the same in both though, so any effort spent with Om now won't go to waste.

One thing we haven't looked at much so far is drumming, but Hydrogen (**www.hydrogen-music.org**) has this covered – it's a sample-based drum synth. You can use it just as an ALSA/JACK synth, but the real beauty of Hydrogen is in its pattern editing and sequencing features. It's essentially a cut-down sequencer designed specifically for drums and drum loops, and it makes it very easy to lay down some patterns and then combine them to produce the beats for a complete track. There's a range of predefined drum kits available on the site, including some commercial options, or you can create your own from any existing drum samples.

Next month!

That's all we've got time for, but we'll be back next issue with more on Hydrogen, the magic of the JACK transport, and the ins-and-outs of multi-track recording.

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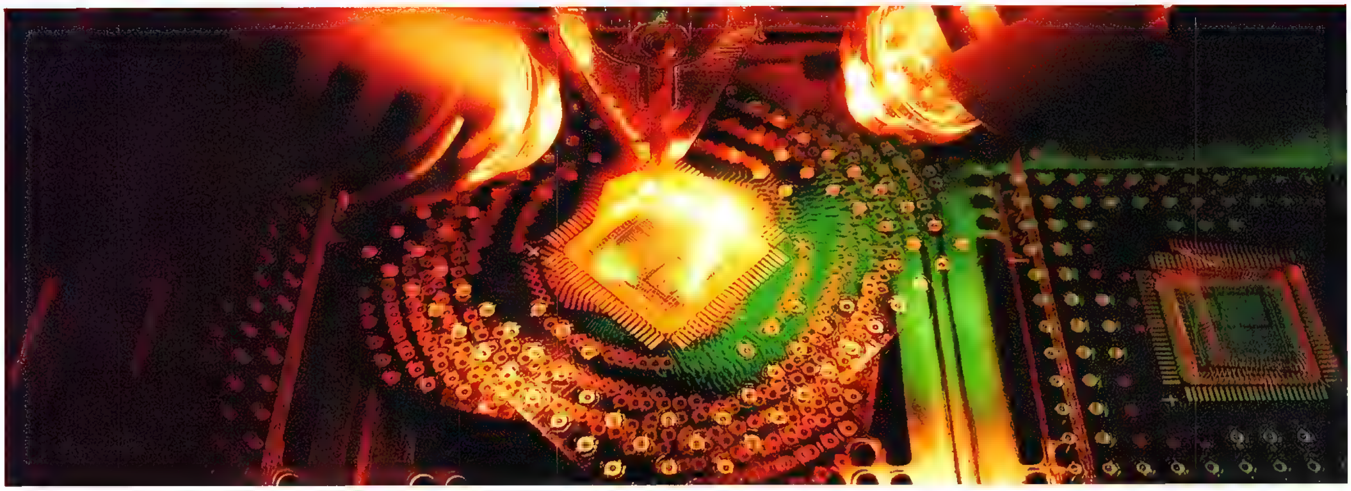


DIFFICULTY **INTERMEDIATE** ●●○○

Optimise Windows for dual-core

Jake Carroll gets under the hood of Microsoft's finest and processes a few threads of his own.

You have a new Intel QX6800 in your box, right? Every man, woman and Morris has one. The truth is the hardware you have – in most situations – is akin to having a Porsche on a dirt road out the back of your uncle's farm. All hotted-up, with no room to move. This month, we will show you a few ways to exploit the potential of your thread-eating, multi-core pride and joy through application, operating system and driver optimisation.

Processing in symmetry

SMP or symmetric multi-processing is the lifeblood of your new multi-core CPU. SMP – in this instance – means that multiple processor cores are directly connected to a single shared main memory region. This SMP architecture allows any one of your processor cores to work on any set of threads in the pipeline no matter where the data for that set of threads is located in memory. More importantly, with an appropriately written operating system and thread scheduler, your threads can be balanced across multiple cores at once.

Recent trends in benchmarking have shown us that while multi-core processors are benchmarking well in highly-threaded, floating point-intensive applications – video encoding, audio encoding, scan-line rendering et al – the processors have for the most part only shown small gains in the things that many computing enthusiasts care most about. Desktop applications, gaming and operating system performance tend to fall by the way-side. There are a few things we can do to rectify some of these performance discrepancies.

Tuning desktop applications for multi-core

Threads themselves are the separate programmatic running processes that are spawned by an instruction from your executable binaries. The more threads you can run at one time, within a single application, the better the ability of the application to take advantage of physical processor resources – within reason. If your applications are running on a single thread, the chances are they will still offload processing to more than a single core – hence, you'll rarely see any of your cores completely idle – but will rarely attain their maximum potential, load-balancing across several cores without intervention. It can, in some cases, be detrimental to application performance when poorly-threaded applications attempt to load balance across multiple cores.

Pump your process priority up

Like putting nitrous-oxide in your transport, changing process priorities has its fair share of risks. What it does is give your applications more of a chance to take advantage of multiple-core time, before other processes get close to fetch-execute-decode time. What happens when important system processes don't make it on time? Do they stall? Our general advice is that increasing a running processes priority to real-time is not something you should do in mission critical situations under an NT kernel – WinXP, Windows Vista, Win2k3. 32-bit Windows operating systems schedule threads on 32 priority levels, numbered 0 to 31. The thread with the highest priority is sent to the execution stack first. As threads wait to be processed, their priority levels are increased. The base application priority determines the priority level at which a threads begin. The following table shows the priority levels for each of the definable settings, when you right click on a process in task manager.

Process priority flag	Priority assigned
Real-time	24
High	13
Above Normal	9
Normal	8
Below Normal	7
Low	4

Process priority table for the NT kernel
Try increasing the priority on your next DVD encoding session, or perhaps your next Adobe Acrobat Professional 8.0 large volume PDF writing session. You'll find in such situations, while your processor usage will be increased across multiple cores, other aspects of system responsiveness may be degraded.

Changing your processor affinity

This one is a bit more complex. When you right click on your processes in the Windows Task Manager, you are given the 'Set affinity' option. This action lets you limit the execution of the process to a selected processor. In the case of a QX6800, processors 0, 1, 2 or 3. If you are willing to micro-manage certain processes such as one session of Adobe Audition, one session of Maya and one session of Blender, you could assign Adobe Audition to proc0, Maya to proc1 and Blender to proc2. This will have the effect of dedicating each process to that related core. Segregating processes like this can greatly improve the chances of the process getting dedicated time throughout the FDE cycle if it isn't a highly-threaded

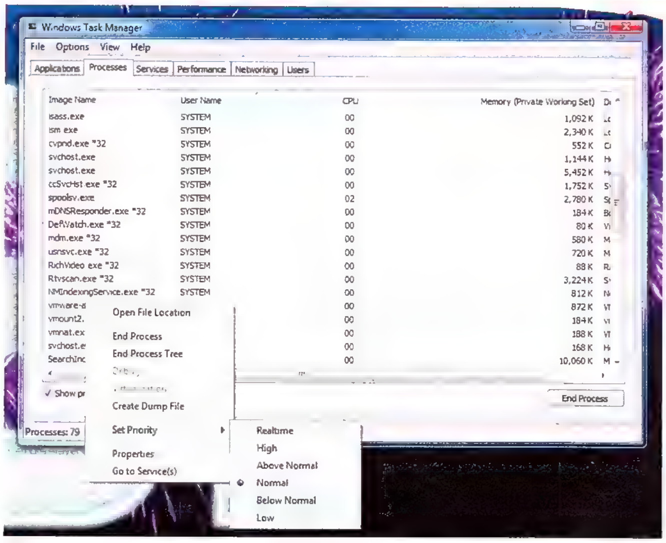


Image Name	User Name	CPU	Memory (Private Working Set)	D
isass.exe	SYSTEM	00	1,092 K	Lc
ism exe	SYSTEM	00	2,340 K	Lc
cvpnd.exe *32	SYSTEM	00	552 K	Ci
svchost.exe	SYSTEM	00	1,144 K	H
svchost.exe	SYSTEM	00	5,452 K	H
ccSvcHst exe *32	SYSTEM	00	1,752 K	S
spoolsv.exe	SYSTEM	02	2,780 K	S
mDNSResponder.exe *32	SYSTEM	00	184 K	B
DefWatch.exe *32	SYSTEM	00	80 K	V
mdm.exe *32	SYSTEM	00	580 K	M
usnsvc.exe *32	SYSTEM	00	720 K	M
RichVideo exe *32	SYSTEM	00	88 K	R
Rtvscan.exe *32	SYSTEM	00	3,224 K	S
NMIndexingService.exe *32	SYSTEM	00	812 K	N
vmware-s		00	872 K	V
vmount2.		00	184 K	V
vmnat.ex		00	188 K	V
svchost.e		00	168 K	H
SearchInc		00	10,060 K	M

Processes: 79

▲ **Figure 1 – Vista process priority control.**

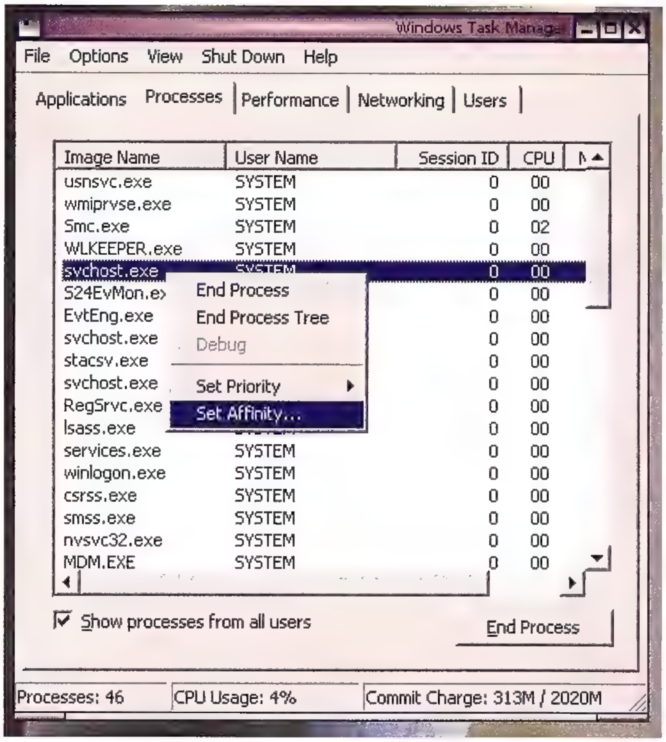


Image Name	User Name	Session ID	CPU	M
usnsvc.exe	SYSTEM	0	00	
wmiprvse.exe	SYSTEM	0	00	
Smc.exe	SYSTEM	0	02	
WLKEEPER.exe	SYSTEM	0	00	
svchost.exe	SYSTEM	0	00	
S24EvMon.e>		0	00	
EvtEng.exe		0	00	
svchost.exe		0	00	
stacsv.exe		0	00	
svchost.exe		0	00	
RegSrvc.exe		0	00	
lsass.exe		0	00	
services.exe	SYSTEM	0	00	
winlogon.exe	SYSTEM	0	00	
csrss.exe	SYSTEM	0	00	
smss.exe	SYSTEM	0	00	
nvsvc32.exe	SYSTEM	0	00	
MDM.EXE	SYSTEM	0	00	

☑ Show processes from all users

Processes: 46 | CPU Usage: 4% | Commit Charge: 313M / 2020M

▲ **Figure 2 – Processor affinity on right click.**

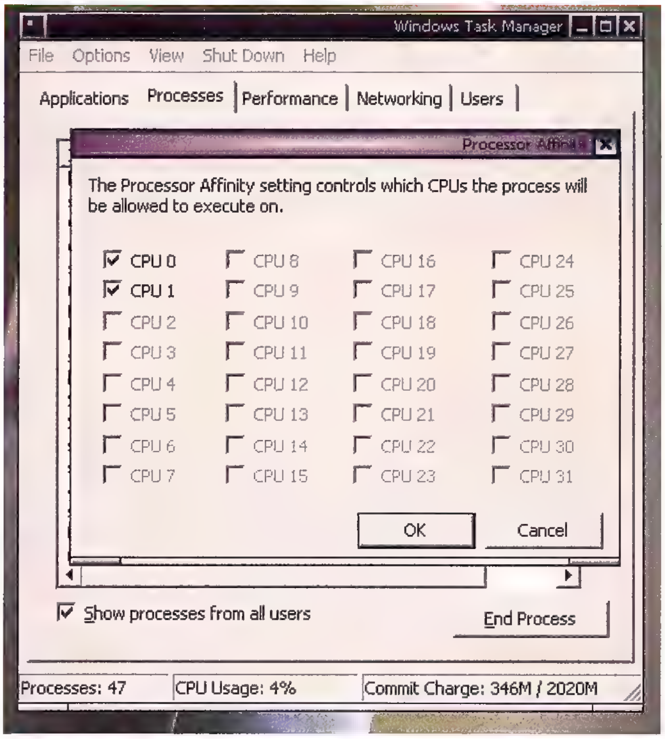
application. This however, is dependent on the underlying operating system (discussed later). Processor affinity binding from the Windows XP/Vista GUI is shown in figures 2 and 3.

You can automate this process, so that you don't have to set your process affinities for different applications on every boot by using ImageConfig: **www.robpol86.com/Pages/imagecfg.php**

Interrupt juggling

Even more complex again, we can actually assign groups or interrupt sets to physical processors. Binding of device interrupts to particular processors on multi-core systems is a useful technique to maximise performance, scaling and partitioning. Interrupt-Affinity Filter (IntFiltr) is an interrupt-binding tool that permits you to establish affinity for device processors on multi-core hardware.

IntFilter can be downloaded from the Microsoft Windows 2003 resources kit companion pages: **support.microsoft.com/kb/252867**


Windows Task Manager
File Options View Shut Down Help
Applications Processes Performance Networking Users
Processor Affinity
OK
Cancel
End Process

The Processor Affinity setting controls which CPUs the process will be allowed to execute on.

☑ CPU 0
☑ CPU 1
☐ CPU 2
☐ CPU 3
☐ CPU 4
☐ CPU 5
☐ CPU 6
☐ CPU 7
☐ CPU 8
☐ CPU 9
☐ CPU 10
☐ CPU 11
☐ CPU 12
☐ CPU 13
☐ CPU 14
☐ CPU 15
☐ CPU 16
☐ CPU 17
☐ CPU 18
☐ CPU 19
☐ CPU 20
☐ CPU 21
☐ CPU 22
☐ CPU 23
☐ CPU 24
☐ CPU 25
☐ CPU 26
☐ CPU 27
☐ CPU 28
☐ CPU 29
☐ CPU 30
☐ CPU 31

☑ Show processes from all users

Processes: 47 | CPU Usage: 4% | Commit Charge: 346M / 2020M

▲ **Figure 3 – IntFilter interrupt binding tools.**

Using highly-threaded applications

You'd think it would be a no-brainer, but things just aren't that simple. When you are seeking out an application to perform a task, be it DVD encoding, movie authoring, audio rendering, database compacting, image processing or otherwise, be conscious of the vendor notes. 'Optimised for dual-core' or 'Designed for SMP environments', is what we are looking for. Many vendors now actively offer SMP-aware versions of their applications. Companies such as Adobe, SlySoft, Elaborate Bytes, Canopus, Ahead and Sony ship most of their products with a highly-threaded codebase. The best examples we can give are situations such as:

- Don't use 3DSMax 7. Use 8 or 9.
- Don't use DVDShrink. Use CloneDVD2.
- Don't use Photoshop 6 or 7. Use 9 (CS2) or 10 (CS3).
- Don't use Sonic Foundry's Soundforge 6 or below. Use Sony's 8 or a greater.

At this point, it is common sense. The newer versions of the applications support highly-threaded execution.

Operating system choices for multi-core

Not all operating system processor time schedulers are created equal. While it is easy – and occasionally correct – to argue that UNIX-like operating systems have superior and/or more efficient processor scheduling methods, our main aim here is to help the Windows-based enthusiasts with their multi-core performance, so we will resist looking into UNIX-like OSes.

NT 5.1 (XP) and NT 5.2 (Win2k3) support multiple physical and virtual processors out of the box. The processor time scheduler in the NT kernel is primarily based on the priorities table discussed earlier in this article. The problem with this, in such heavily-threaded executable environments, is that thread starvation can occur.

Keep in mind that the operating system is the very life of your system. If it doesn't work well, none of the higher level abstract actions or events – such as those described in the first part of our article – will either. The answer to this cluggy thread and processor time scheduling is to use a more appropriate operating system. How does Vista fix what XP didn't get right? How does it benefit you in a multi-core world?

All versions of the NT kernel require an interval-timer interrupt routine to execute every ~10ms. The routine looks at what thread it interrupted and updates the thread's CPU usage stats as if the thread had run for an entire interval – when in reality the thread might have just started just before the intervals end.

The thread may have been assigned to a CPU – or multiple cores! – but didn't get the chance to run because hardware and software interrupt routines stopped it short of this instead. This can cause unfair CPU allocation. In this model, a thread might get little or no time on the CPU to execute and do any work.

Figure 6 shows how the unfair scheduling can occur when two threads have the same priority and become ready to run concurrently.

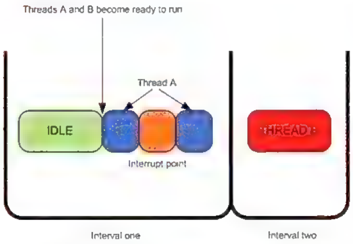


Figure 6 – Thread scheduling in Windows XP2K3.

In Vista, the scheduler uses cycle counter registers to track how many CPU cycles a thread executes. By estimating how many cycles the CPU can execute per clock interval, it can more accurately apportion turns on the CPU. The Vista scheduler doesn't count interrupt execution either. This means that a thread will always get at least its turn on the CPU and never more than an extra clock interval of execution, resulting in greater fairness and more deterministic execution. Figure 7 shows how Vista responds to the scenario shown in figure 6 by giving both threads at least one time slice interval of execution.

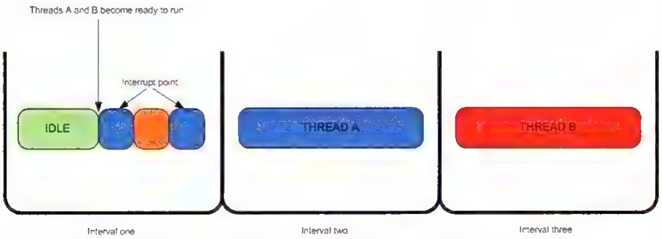


Figure 7 – Thread scheduling in Windows Vista Server 2008

The simple answer is to go out and buy Vista for your big new boxen. Is it the economical or rational choice given the operating system's maturity? Probably not. Be well informed however – it will become a more and more appropriate choice as the underlying applications built for it take better advantage of multi-core environments. XP will no longer be 'faster', and it will hamper your performance, in time.

Graphics, sound and gaming in multi-core

So we now have a way to control the threading priority of your executables. We can also tell them what cores to process on. We even have an operating system that treats your threading model with a little more respect than previous efforts. We are still missing some 'glue' however. Drivers and APIs.

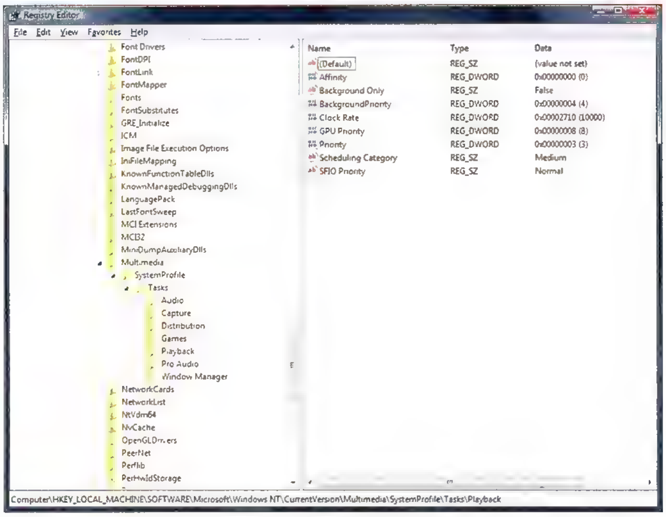
When you are gaming, you are exercising your system in ways that desktop applications rarely elevate to. CPU utilisation, GPU throughput and SPU decoding are all intensive. Multi-core games are becoming more common, slowly but surely. Supreme Commander, Command & Conquer 3, Crytek's Crysis and the next iteration of Half-Life 2 are all catering to the QX6800 in ways that haven't been seen in previous games. The challenge for game developers, is finding ways to parallelise their code to the level that a QX6800 can best make use of. The types of threading that game developers use fall into a few categories:

- Single threading – throwing a single thread on the pipeline. The CPU will deal with it and load balance.
- Course threading – splitting 'systems' between discrete cores. An example might be putting AI on proc0, physics on proc1, GPU offloading on proc2 and networking on proc3.
- Fine-grain threading – making many of the same process and splitting them across different cores.
- Hybrid threading – a mixture of course and fine grain threading.

Both Valve and Crytek are currently embarking on their implementation of hybrid threading. To get the most from it you need to be running the appropriate 'glue'. First and foremost, if you're using an NVIDIA card, the drivers must be current. Since the 96.xx series drivers, NVIDIA has been releasing multi-threaded drivers for its video hardware, as has ATI in the form of its Catalyst driver sets. Similarly, SPUs such as the Creative X-Fi series have highly optimised multi-threaded drivers available for download. Don't neglect to use the most current driver. Doing so could seriously hamper your performance.

Next, there are a few dark secrets Vista hides, concerning GPU, SPU and processor performance for threading, found here in the registry:

HKEY_LOCAL_MACHINE\Software\Microsoft\Windows NT\Currentversion\Multimedia\SystemProfile\Tasks



Name	Type	Data
(Default)	REG_SZ	(value not set)
Affinity	REG_DWORD	0x00000000 (0)
Background Only	REG_SZ	False
BackgroundPriority	REG_DWORD	0x00000004 (4)
Clock Rate	REG_DWORD	0x00002710 (10000)
GPU Priority	REG_DWORD	0x00000008 (8)
Priority	REG_DWORD	0x00000003 (3)
Scheduling Category	REG_SZ	Medium
SFIO Priority	REG_SZ	Normal

Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Multimedia\SystemProfile\Tasks\Playback

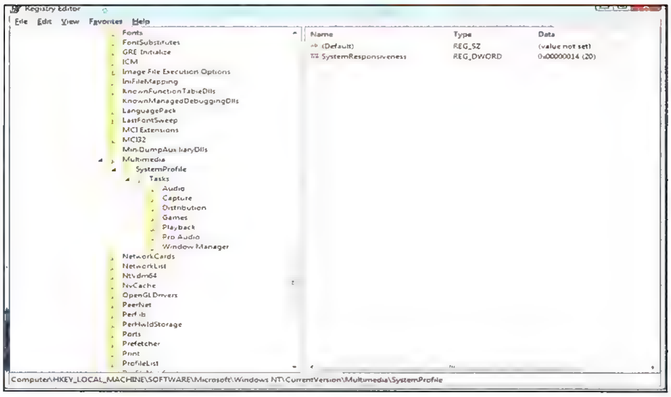
Figure 8 – Vista registry addition for GPU priority.

Here, with some care, you can change the thread allocation priority for your GPU and SPU. Experiment with the values for GPU priority and do some benchmarking. The results may surprise you!

Going a step further, we can tune system-responsiveness as a function of the trade-off between pushing threads quickly out or letting background tasks process quicker by using the following registry entry:

HKLM\Software\Microsoft\Windows NT\Currentversion\Multimedia\SystemProfile\SystemResponsiveness

Until next time, take your threads seriously!



Name	Type	Data
(Default)	REG_SZ	(value not set)
SystemResponsiveness	REG_DWORD	0x00000014 (20)

Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Multimedia\SystemProfile

Figure 9 – Vista registry addition for system responsiveness.

atomic

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We're upgraded and added many exciting new features to your atomic site.

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I/O OF THE MONTH

Disk watts

I am thinking of installing a new Seagate 500GB SATA HDD in my PC, however I am unsure if my power supply can run another drive.

My PC has one HDD and two optical drives at the moment (no floppy), a 430W Thermaltake PSU, an Athlon X2 4200+ and a Gigabyte Radeon X1900XTX 512MB video card.

Will I be able to add the aforementioned 500GB drive without changing power supplies? Presently my machine is very stable.

Michael Hancock

If it's working really hard, your current PC probably draws almost 300 watts – but the average power even when playing a game is likely to be more like 250W. Plenty of headroom there, even if your '430W' PSU is, like most PSUs, rather optimistically rated.

There's one way, however, in which adding a new drive can bite you.

Most hard drives have basic current-draw numbers on their label – it'll say something like '5VCD: 0.95A 12VDC: 0.80A'. That means 4.75 watts on the 5-volt rail and 9.6 watts on the 12-volt one, but it's only an average. The datasheet from the manufacturer's site should have a proper breakdown of idle, sleep, active and startup power.

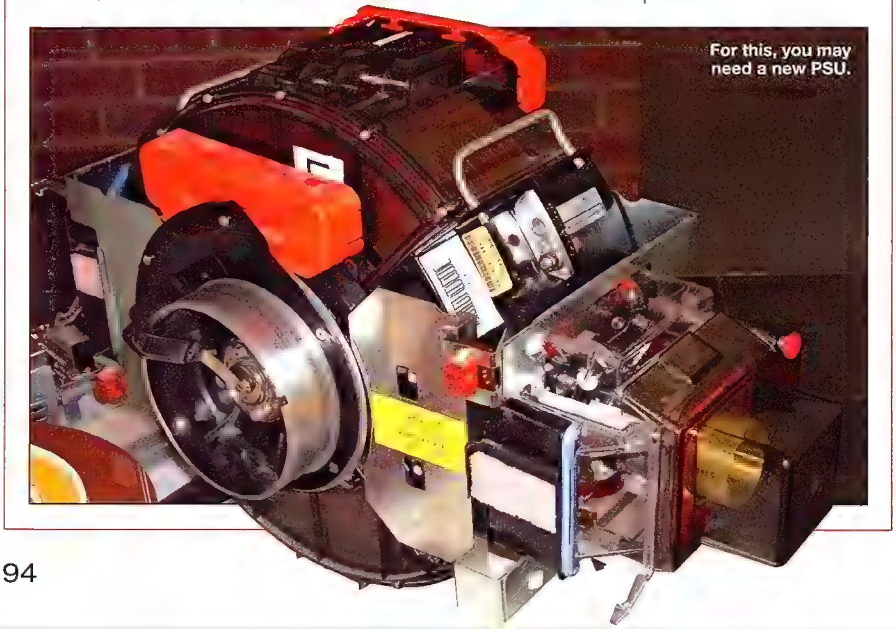
That last figure can be as much as 30 watts, for a current 500GB 7200rpm drive, and that can cause problems.

If four drives all spin up at once – as they will, when you turn the computer on – then for the first moment of the spin-up they can demand well over a hundred watts between them. Not good.

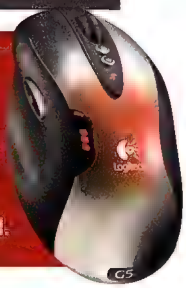
That may push your PSU over the line, and prevent the computer from booting as it should.

PATA drives in a master/slave configuration on the one cable may automatically stagger their spin-up, and some ATA drives have a jumper on the back to activate selective spin-up, too. I don't think current consumer Seagates do, though, and the jumper won't work at all if the controller doesn't support it.

If your computer isn't on the edge already, though – and yours isn't – adding one more drive won't cause a problem.



For this, you may need a new PSU.



I/O OTM wins a Logitech G5!

There's a mouse in the house. Okay, it's not in the house, it's in I/O. And it looks damn good.

Transcendental, man!

I've never really understood pi. It equals 3.14 which is the ratio of a circle's circumference to its diameter, it's used heavily at school in maths classrooms, but there's something odd about it. It never ends. I first caught on to how long it was when mates would recite the first 50 or so numbers at lunch time.

I've discovered an easy way to fault pi. Imagine anything of any size, but for the sake of argument something small, like a cigarette. Now divide it into three equal parts and take a hard look at each part. Each part is of equal size and does not skew off into the eternal distance, you can see each part with your own eyes; pick it up, play with it!

I pick up 1/3 and I'm holding it – how can it be a never-ending number? Wouldn't the part I'm holding physically reach the stars and beyond?

Steve Richards

Point 1: An irrational number is not an infinite number. Pi is equal to three-point-one-four blah blah blah. You can extend that blah blah as far as you like, without reaching three-point-one-five anything. All the extra digits do is refine your definition of the number, not enlarge it.

Point 2: In the physical world, no actual object has any irrational-number dimensions.

In Geometry Land you can take exactly a metre of perfect unstretchable one-dimensional wire, form it into a perfect circle, measure its diameter and end up with one-on-pi metres.

But in the real world the diameter would only be exact to a few decimal places, just as the original length of the wire would only be exact to a few decimal places, no matter how carefully you cut it.

Pi, as an irrational number, can't be described as any whole number divided by any other whole number. You can roughly approximate pi as 22 divided by 7, or you can more closely approximate it as 355 divided by 113, and you can keep on shooting closer and closer to the real value with more and more digits in your fraction, but you can never quite hit it. And that's fine, for reasons philosophically analogous to the reasons why no object in the real world can ever quite hit *any* particular exact dimension. A metre-stick isn't exactly a metre long, and neither is the old platinum-iridium metre standard.

It is, of course, theoretically possible for a physical object at some particular time to embody pi as truly perfectly as can be measured. But it'll take surprisingly few decimal places before the length of your pi-metre-long platinum-iridium rod at a perfectly even temperature becomes unquantifiable, as you get down to the inescapably spongy and lumpy atoms that make up its ends.

As a matter of fact, the ten significant digits of pi that're stamped into the brain of anybody who spent six years of high school maths stabbing randomly at their scientific calculator pretty closely match how close any real world 'pi-metre long' object can *possibly* be to a genuine pi metres in length.

New CPU cooler - only $500,000,000!

I've been looking up information on liquid cooling, and was wondering how effective diamonds, either low-grade, leftovers from cutting or lab-created, would be as liquid blocks and heat sinks – considering their high thermal conductivity and specific heat capacity?

Starlite

Oh, they'd be very effective, as long as you didn't have too much trouble forming them into the right shapes.

Unfortunately, diamond pieces big enough to be useful for this purpose are also what we like to call *colossally* expensive.

This is changing – the great thermal conductivity of diamond makes it attractive as a heat path inside CPU packages and such, and synthesis techniques to make diamond in appropriate shapes are a growth industry. We're a long way away from being able to make sizeable components out of contiguous diamond, though.

The bulk industrial diamond that you get on hardware-store saw blade teeth is either made in a factory using low-cost methods that produce tiny stones (which might perhaps be slightly useful as loading material for thermal grease, at the cost of making it abrasive...), or dug up out of the ground. Those latter stones are the 'rejects' of the gem industry – stones that aren't useful for jewellery either because they're not clear and pretty, or because they're too small, or both.

Dude – I could make an *excellent* CPU cooler out of that!

If there was no demand for large pieces of sub-gem-quality diamond then I suppose it'd be available at reasonable prices for thermal applications. But those pieces are actually useful for things like super-hard bearings and diamond anvils for ultra-high-pressure lab applications. So they remain really expensive.

A one-gram brown and ugly diamond will cost you considerably less than a one-gram gem-quality stone. But one gram is *five* carats, so it still won't be cheap.

A piece of industrial diamond the size of a normal CPU heat sink, say a 5cm cube, would weigh about 87.5 grams – around four times the mass of the Koh-i-Noor diamond. It'd be worth a great deal less than that stone, but the mathematics becomes a bit complex when you try to divide 'priceless' by any number.

The weight of a bit

I bought an 8GB flash drive ages ago and it's the biggest I've had so far in the portable memory stakes. I finally got around to filling the sucker up, and I've been carrying it with me everywhere I go. At first when it was empty, it felt pretty light, sought of weightless, but lately carrying around this 8GB chunk of data, it feels as if it's gotten heavier.

I don't think my mind's playing tricks on me, but I've never really looked into it too much either. To me, data is something that has weight to it and something that you could physically see, manipulate etc, under the right circumstances and if you knew what you were doing.

Is data really 'virtual' like they say it is? Or is data more real then what people think it is?

Julien Bonastre

A piece of paper weighs a tiny bit more when you've written on it, as you've added ink or graphite. But computer storage systems store data by changing the state of things that are already there.

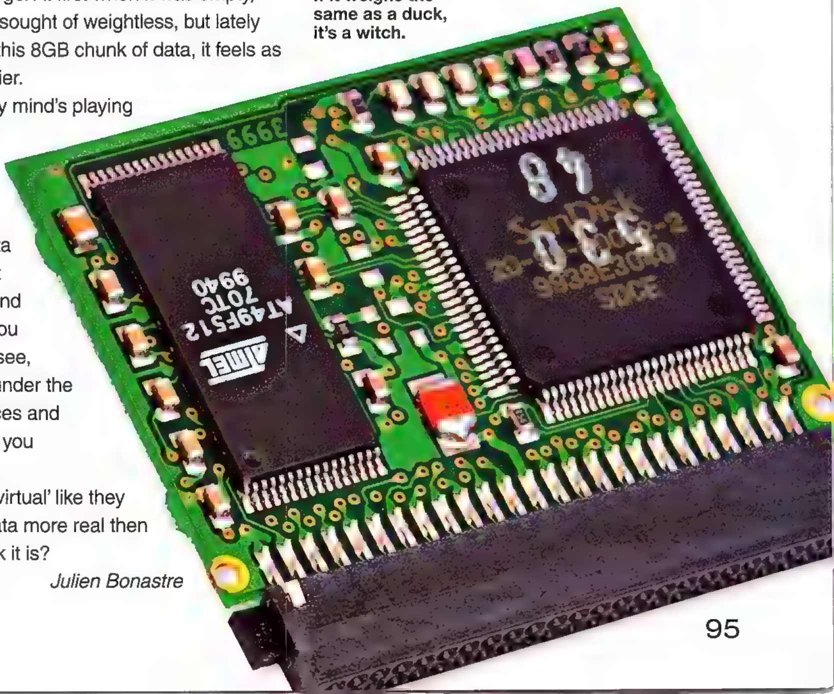
Think of an empty flash drive as a long line of coins all placed with the head side up. Writing data to the device involves turning some of the coins tails up. That doesn't make the coins change in mass.

I've been trying to think of a computer storage system that *does* get heavier when you write to it, but I can't come up with one, even going back to mercury delay lines. All I can think of are devices that get *lighter* when written. Write-once optical discs might get a tiny bit lighter when written to if the vaporised dye manages to seep out of the disc, and good old paper tape and punched cards get lighter when you punch holes out of them.

This isn't because of some mystic 'weight of data', of course. You're just removing some of the physical substance of the device to encode information in it.

Batteries and capacitors don't get heavier when you charge them, either. Charging a battery or cap isn't like filling a bucket; the electrons you pump into a battery to charge it come straight back out again (or, at least, an equal number of other electrons do...), having done work in the meantime by changing the chemical makeup of the battery's electrodes.

When you charge a capacitor, you're pushing electrons off one of its internal plates and onto the other. The total electron count doesn't change, and neither does the cap's mass. Flash RAM, at base, depends on a capacitive process (each flash 'cell' is a transistor/capacitor hybrid), so it doesn't change in mass when 'filled', either.

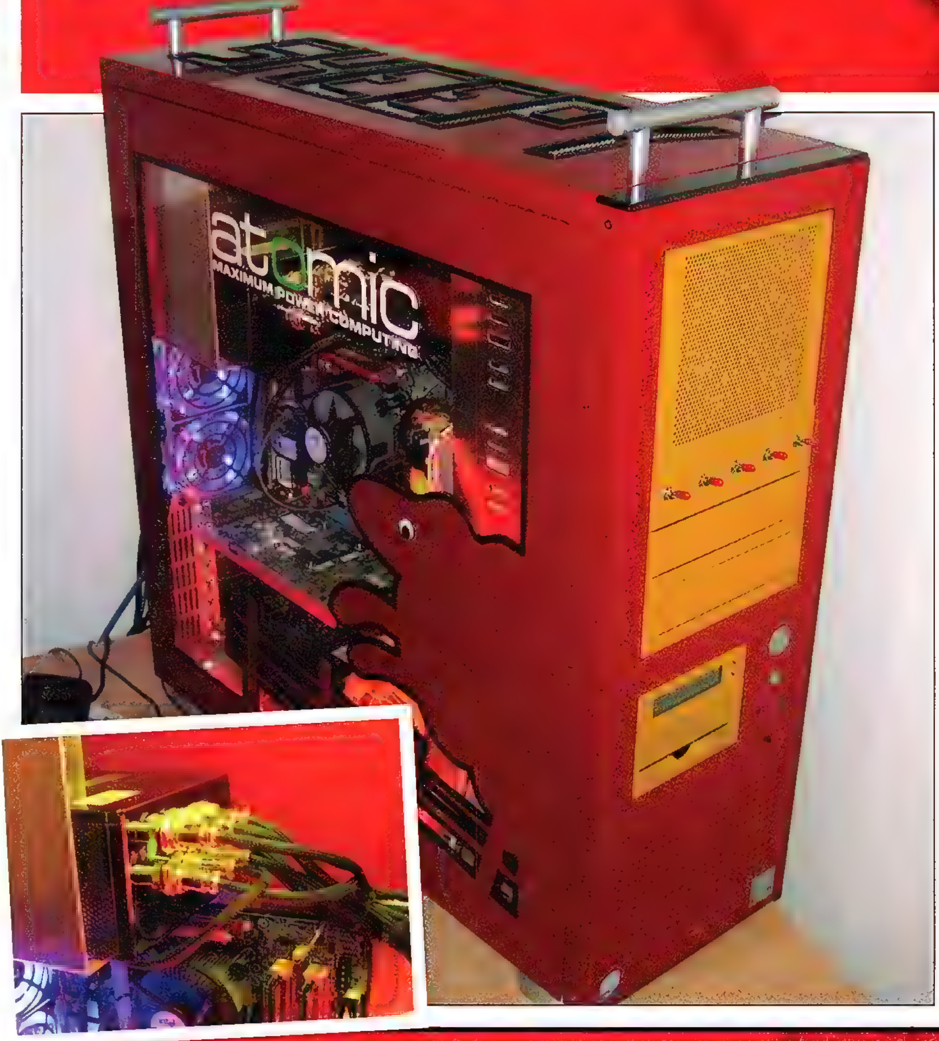

If it weighs the same as a duck, it's a witch.

ATOMICHOTBOX

The best reader-submitted custom made boxes every month

Welcome to Hotbox! Gaze on the best case mods Australia and NZ have to offer! If you think you box is up to scratch, submit it to **hotbox@atomicmpc.com.au.**

hotbox OF THE MONTH



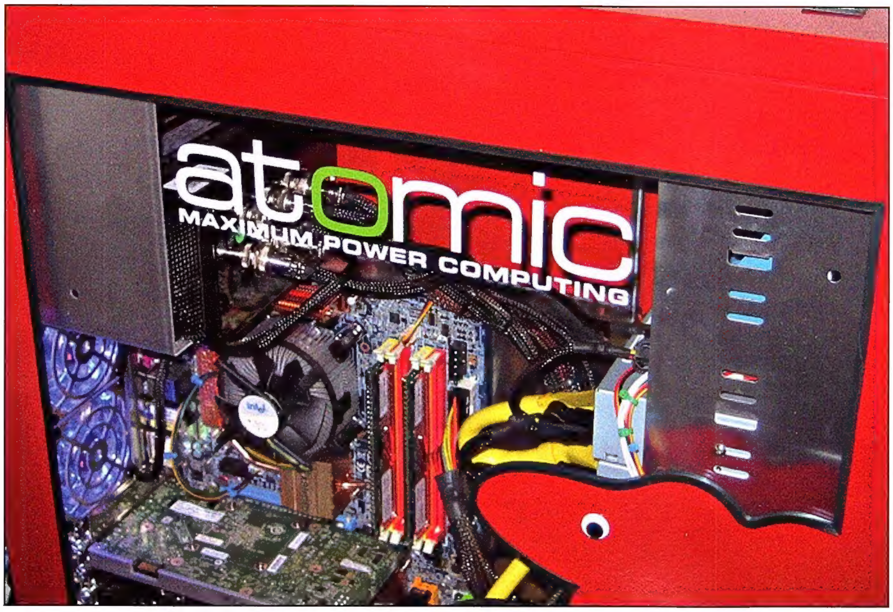
Lambo's Sheepy Mark II

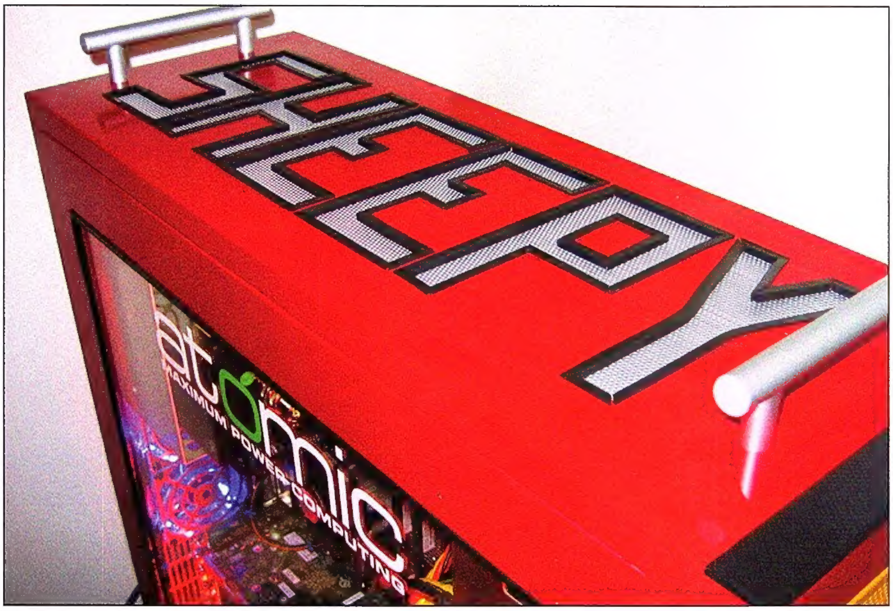
Sheepy Mark II is the successor to Sheepy, my original case mod (*issue 41*), and just like the first, adding lights and windows wasn't enough – it had to be personal, fun, and most of all, sheepy. The canvas I started with was the Lian Li PC70 server case – a stunning case, even un-modded, with huge side panels. The window for the case was inspired by illustrations from old children's books of people counting sheep. It was going to be just the sheep, but as the side panel window was so large, it would have looked too empty, so the fence idea quickly grew on me. I liked the idea of having my sheep jumping in from the side of a window over the fence.

The top of the case was originally intended to be a window, but as I'd done that already I decided to showcase the name of the case instead, and cut out the word 'Sheepy' with a large metal grill behind it to allow air and light through. In Bunnings, I came across some nice silver draw handles that would look great on the top, though it should be said are more for looks than any functional use – the PC fully decked-out is very heavy.

Fame, fortune and free stuff can be yours! Send your Hotbox to
hotbox@atomicmpc.com.au
and make sure you include the following details so you can be eligible:

- Six to 12 high res, well-lit, pics of the inside and outside of your case
- A 500-word description of how you made it, the obstacles you overcame, the tools you used, and your inspiration
- A detailed list of the machine's specs. Include CPU, video card and RAM





The toughest part was the painting. Armed only with high-gloss enamel spray can, I set to work on the panels. You should never assume that you can do this without adding primer to your panels! After what seemed like a billion coats of 'Cherry red' and 'Yellow' for the front bezels, it was time for the custom fan/light switches. I found some nice-looking switches at my local Dick Smith and set about turning one of the empty 5.25-inch front bays into a fan/switching module. My first attempt at wiring the switches shorted my test PC, my second attempt just made the PC turn off! Third times a charm, and I had the lights and fans switching on/off. Let this be a lesson – never trust your first attempt on your main PC!

The final process was attaching the window, adding the rubber moulding to the top and side of the case, and tidying up all the wires – I opted for a new Hiper PSU with cable management.

All up the mod took about four months of on/off work and I'm exceptionally pleased with it! A special thank you to my Dad who helped a lot with the initial cutting and window work.

technicaldetails

CPU

Intel Core 2 Duo E6600

VIDEO

XFX 7900GT 256MB PCIe

RAM

2GB OCZ DDR-800

EXTRAS

- **Lian Li PC70 server case**
- **Hiper Type-R 580 watt PSU**
- **1x 250GB SATA II HDD**
- **2x 200GB SATA II HDD (RAID 0)**
- **2x 400GB SATA II HDD (RAID 0)**
- **Creative Sound Blaster Audigy 2**
- **Pioneer DVR-110**
- **Lite-On 48x CD-RW**

Hotbox of the month wins a
Gigabyte GA-P35-DS4!

- Intel Core 2 Extreme/ Core 2 Duo/Pentium D
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- Silent Pipe cooling design
- Dual PCIe for CrossFire
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FALLOUT Funnies and humour from the fallout zone

Hats are essential if you want to look your best, making them a valuable commodity in any age.

Spoils of nuclear war

Logan Booker has two teeth and a pile of dirt to offer.

Maverest shook his head. Then, he shook it again.

'I believe there's been a mistake. An error, of sorts.'

Standing across the counter from Maverest, trying not to fall to pieces, was Garry. Garry was a ghoul, his body rotten from years of high-intensity gamma radiation. So not falling to pieces basically involved him pressing both hands against his head to prevent his ears from dropping off.

Garry smiled his famous, lipless grin. He looked like a muscled skeleton getting a face lift. 'Everythin's in order, mate. I checkeds it meself.'

Garry also sounded like a pirate from south London, and would've been right at home on a galley sailing the high seas, as long as you were partial to skinless talking cadavers and their associated smells.

Maverest surveyed the deal for the third time. On his side of the table sat a syringe of Rad-Be-Gone, the strongest anti-radiation medication money could buy.

However, considering money had about as much value as teeth since the nuclear war, instead of a pile of crisp, hundred-dollar bills stacked nicely as an offering from Garry, the mutant, in his incredible wisdom, had a collection of molars, canines and other orally-sourced currency sitting neatly in front of him.

'I can't take those, Garry. You know that. What the hell am I supposed to do with a bunch of teeth?'

The mutant glared at him, trying to deduce what the correct response would be. Garry was also lacking a set of eyelids, so glaring was pretty much *all* he did.

His jaw creaked open. 'Teef's are good for loads of fings,' he said. 'Say, replacin' ones you mights have lost.'

Maverest, luckily, had a full set of chompers. The same could not be said of Garry.

'Plus,' the mutant added, 'they're the freshes' pile o' teef you'll finds this sides of the crater.'

'Well, that goes without saying,' replied Maverest. 'I watched you pull them out of your own head barely three minutes ago.'

Garry just nodded, slowly, as if confirming some obscure urban myth, his hands still plastered firmly in place. Maverest could see the deal was dissolving… fast. 'Look, just give me the rifle, like we agreed, and I'll give you the shot. I haven't got time to renegotiate.'

Garry remained unconvinced. Maverest sighed; it was time for him to play his trump card.

'Tell you what,' he said in as coaxing a tone as he could muster. 'I'll throw in my hat.'

The mutant's eyes lit up instantly, undoubtedly a side-effect of the many kilos of uranium-235 his body had absorbed over the years. Garry tried desperately to hide his excitement by covering his face with his hands. It was a mistake. His ears quickly plummeted from their cranial berthings and, a second later, two almost simultaneous wet splats emphasised the ghoul's humiliation.

'I'll gets 'em later,' he proffered. Maverest simply nodded. He removed his beloved stovepipe hat from his head and placed it carefully on the table.

'All yours, friend. Now, the rifle.'

Moments later, Maverest strolled out of the ghoul's ramshackle store, the .22 resting happily on his back. Given Garry's degraded intelligence and somewhat corpse-like speed, he gave the mutant 10 minutes to figure out he couldn't wear the hat without ears.

Well, ears that didn't try to escape the second you let go of them anyway.

NEXT MONTH

SEX IN GAMES

Gaming has its underground element. Well, it's not really underground. As adults, we understand that the right amount of mature content can add much to a game – almost as much as it can take away if over-used. *Atomic* has decided to give the topic a proper look.

BUILD YOUR OWN HOME THEATRE PC

Adam Turner has his hands all over home theatre setups. We've asked him to put together a two-part guide on building your own, the *Atomic* way. Don't settle for the amateur guides, you'll get all the info you need right here.

GAME-TO-MOVIE ADAPTATIONS

Christopher Taylor had an axe to grind with Hollywood. Or maybe it's the game developers. Who exactly is to blame for all those game-to-movie atrocities? Chaos theory? Hugh Jackman? Uwe Boll? Find out here.

BURN THE PERFECT DVD

Forget audio discs! The master art of creating the finest data disc is known only to a few. One of those few is Jake Carroll, and next issue he'll be sharing all his secrets. Don't miss this tutorial!

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